Test 1

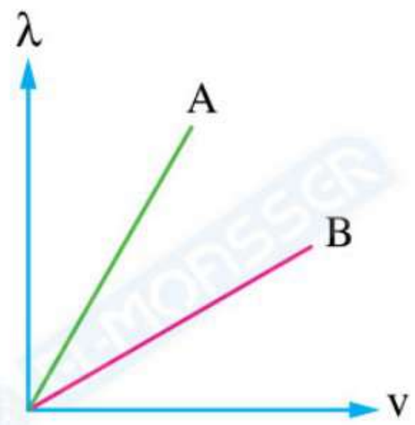
1 A sound source produces 60 vibrations within 1.5 s and the produced wave propagates in air with a speed of 340 m/s, then the distance between the centers of a compression and a successive rarefaction equals ..... .

(a) 2.8 m
(b) 4.25 m
(c) 5.67 m
(d) 8.5 m

2 A student uses in the double-slit experiment laser rays of wavelength 6328 Å. If the distance between the double slit and the observation screen is 85 cm and the distance between the centers of the central fringe and the fourth bright fringe is 1.8 mm, then the distance between the two slits is ..... .

(a) 0.68 mm
(b) 0.8 mm
(c) 1 mm
(d) 1.2 mm

3 The opposite graph shows the relations between the speeds (v) of two different waves (A and B) and their wavelengths (λ) when they propagate through different media, so which of the following relations is correct for the frequency (υ) of the two waves?



(a) $\upsilon_A < \upsilon_B$
(b) $\upsilon_A = \upsilon_B \neq 0$
(c) $\upsilon_A > \upsilon_B$
(d) $\upsilon_A = \upsilon_B = 0$

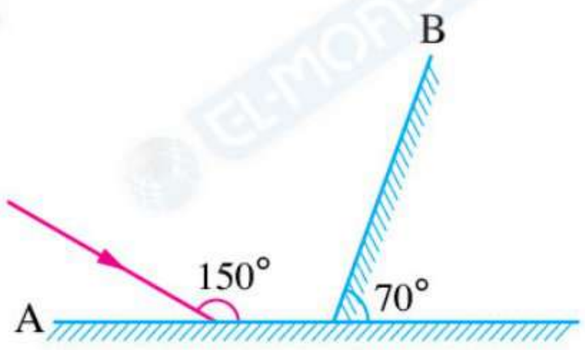
4 Load is attached to a spring where it is in equilibrium, if the load is pulled downwards for a distance 10 cm then it is left to pass by the equilibrium position for the first time after 0.5 s, then ..... .

	The amplitude of the vibration (cm)	The periodic time (s)
(a)	10	1.5
(b)	10	2
(c)	20	2
(d)	20	1.5

5 In Young's experiment a blue light of wavelength λ is used to pass through two narrow slits that are at a distance d from each other, so interference fringes appear with a certain pattern on the observation screen that is at distance R from the slits. If the experiment is repeated under the surface of water, the distance between the fringes will ..... .

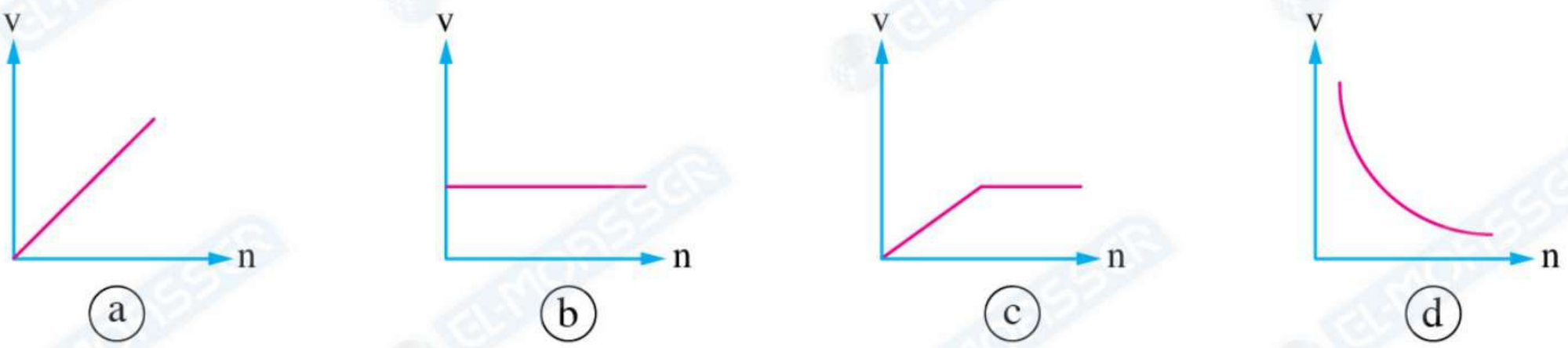
(a) remain constant
(b) decrease
(c) increase
(d) be indeterminable

6 In the opposite figure, the angle of reflection of the light ray on mirror B equals ..... .



(a) 30°
(b) 50°
(c) 60°
(d) 90°

7 The graph that represents the relation between the speed of light (v) in several media and the absolute refractive index (n) for each of them is ..... .



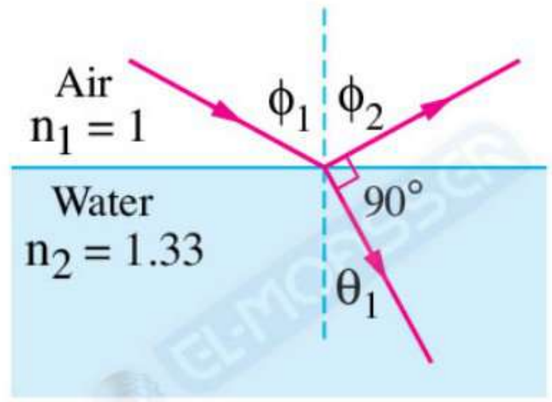
8 The electromagnetic waves in which the diffraction becomes more clearer when they pass through aperture of dimensions 10^{-5} m are ..... .

(a) microwaves
(b) radio waves
(c) gamma rays
(d) UV waves

9 The opposite figure shows the motion of a simple pendulum of periodic time T, so which of the following statements is wrong?

(a) The speed of the load at x > The speed of the load at y
(b) The speed of the load at z = zero
(c) The amplitude = The distance between z and y
(d) The time taken by the load to cover the distance xy = $\frac{T}{4}$

10 From the opposite figure, **calculate** the value of angles ϕ_1 and θ_1. (Knowing that: sin (90 – θ) = cos θ)



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11 "We can't observe the diffraction of light in our daily life" **Explain this sentence.**

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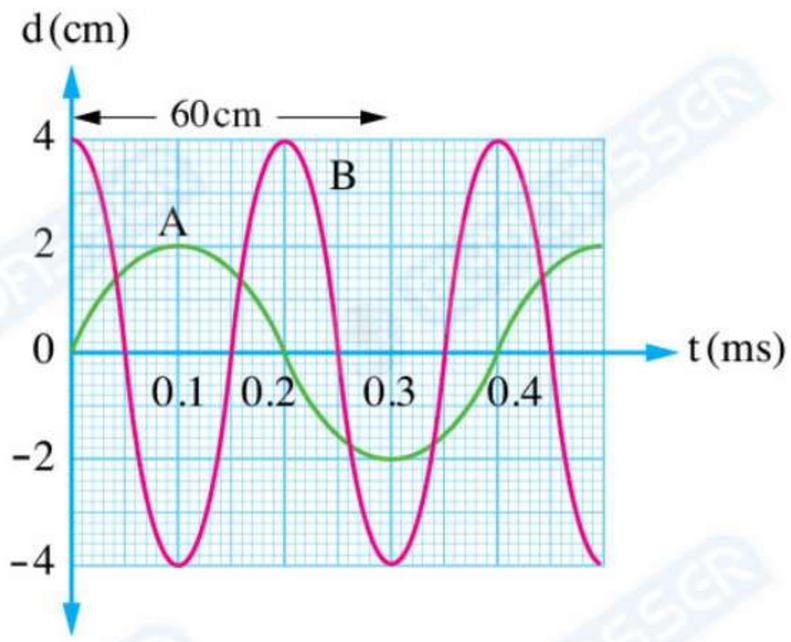
12 The opposite graph shows the relation between the displacement (d) of a particle in a medium and the time (t) for two waves A and B, find the speed of propagation of each wave in the medium.



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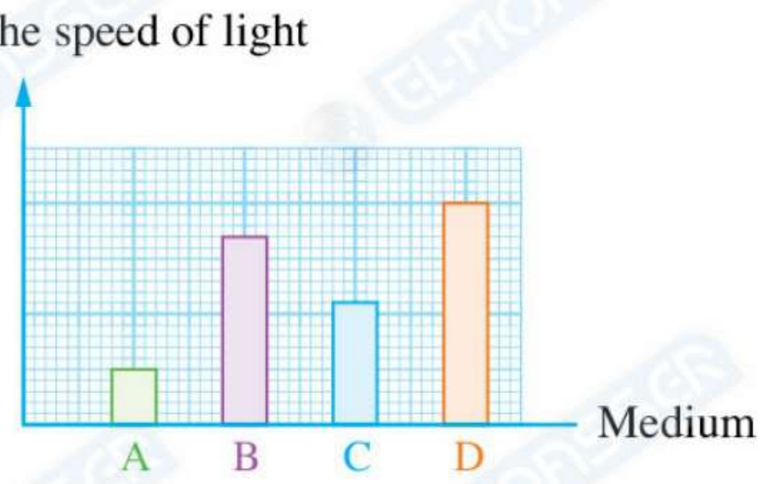
Test 2

1 The opposite figure shows the speed of light in four media A, B, C, D, then the optically denser medium is ..... .



(a) material A (b) material B
(c) material C (d) material D

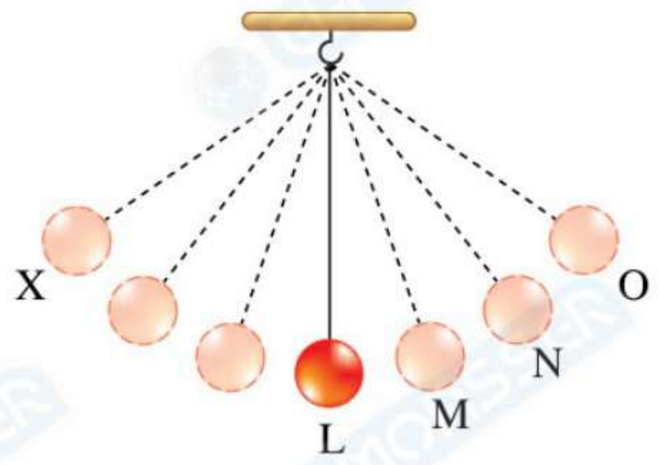
2 In the diffraction phenomenon, the waves path changes, ...

(a) when they transfer from a medium to another
(b) when they fall on a reflecting surface
(c) when they encounters a sharp edge
(d) when they collide with another wave

3 If the refractive index of medium A is double the refractive index of medium B, so the ratio between the speed of the light in medium A and the speed of the light in medium B equals ..... .

(a) $\frac{1}{2}$ (b) $\frac{2}{1}$ (c) $\frac{1}{4}$ (d) $\frac{4}{1}$

4 The opposite figure shows the motion of a simple pendulum from X to O, if the distances ON, NM and ML are equal and the time intervals taken by the pendulum to cover these distances are T_1, T_2, T_3 respectively, then which of the following relations is correct?

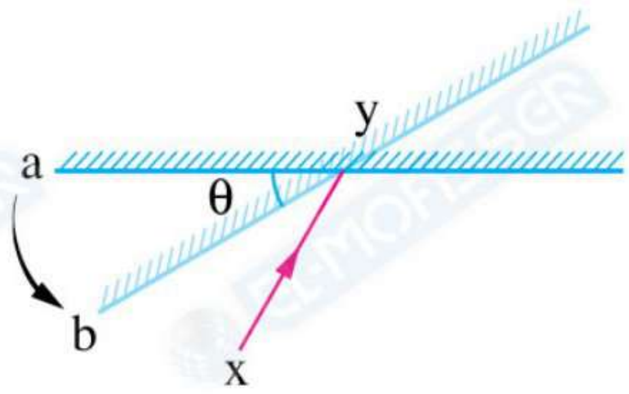


(a) $T_1 = T_2 = T_3$ (b) $T_3 > T_2 > T_1$
(c) $T_1 > T_2 > T_3$ (d) $T_1 + T_2 = T_3$

5 In Young's double slit experiment, when a light of wavelength λ is used, the distance between the centers of the central fringe and the ninth bright fringe was 1.5 cm. If the wavelength of the used light is changed to 1.5 λ, then the distance 1.5 cm will be between the center of the central fringe and the center of the ..... .

(a) third bright fringe (b) sixth bright fringe
(c) ninth bright fringe (d) tenth bright fringe

6 In the opposite figure, a light ray xy falls on a plane mirror in position (a), then the mirror is rotated with angle θ about an axis perpendicular to the page at the point of incidence to be in the position (b), so the angle of reflection increases by a value of ..... .



(a) $\frac{\theta}{2}$ (b) $\frac{\theta}{4}$ (c) θ (d) 2θ

7 The relative refractive index ($_1n_2$) between two media is greater than one in all of the following cases except, when ..... .

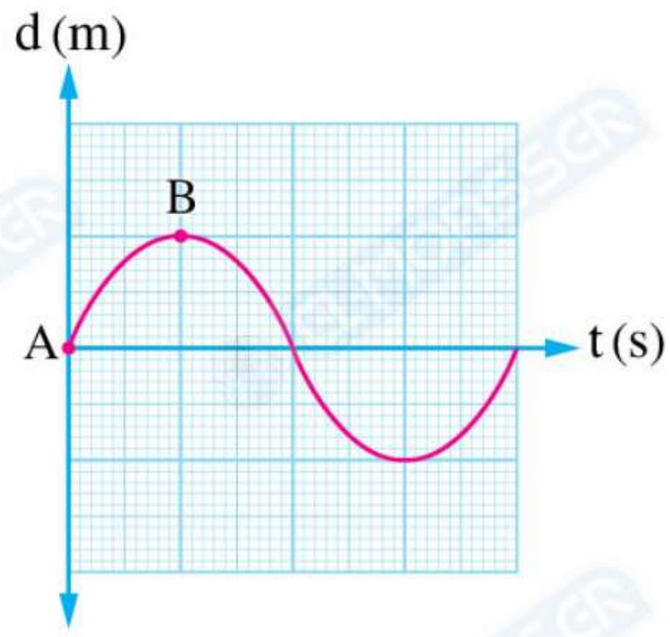
(a) the speed of light in the first medium is greater than its speed in the second medium

(b) the angle of incidence in the first medium is greater than the angle of refractive in the second medium

(c) the absolute refractive index of the first medium is smaller than the absolute refractive index of the second medium

(d) the wavelength of light in the first medium is smaller than the wavelength of light in the second medium

8 The opposite graph shows the relation between the vertical displacement of the motion of a medium particle (d) and the time (t) of a wave. If the time interval between A and B is 0.15 s, then the frequency of the wave equals ..... .



(a) $\frac{1}{15}$ Hz (b) $\frac{1}{3}$ Hz

(c) $\frac{5}{3}$ Hz (d) $\frac{20}{3}$ Hz

9 A horizontal rope is attached to the lower branch of a horizontal tuning fork. If the lower branch of the fork is struck, the fork produces two disturbances one in the rope and the other in air to form mechanical waves of types ..... .

	In the rope	In the air
(a)	longitudinal	transverse
(b)	longitudinal	longitudinal
(c)	transverse	transverse
(d)	transverse	longitudinal

10 Red laser beams are pointed toward three groups of different double-slits (A, B and C). If the separating distances between the two slits in the three groups are 0.15 mm, 0.175 mm and 0.15 mm respectively and the distances between the observation screens and the slits are 0.6 m, 0.8 m and 0.8 m respectively, **arrange in an ascending order** the three groups according to the distance between the center of the central fringe and the center of the first bright fringe.

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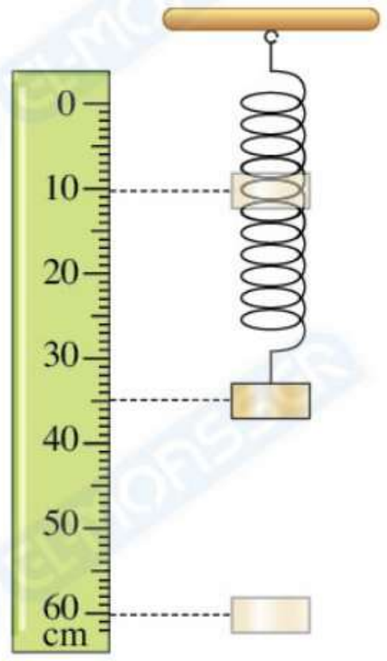
11 A body is suspended in a vertical spring coil besides a ruler where it vibrates between the marks 10 cm, 60 cm. **calculate :**

(a) The amplitude of vibration of the body.

(b) The distance covered by the body during two vibrations.



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12 It is easier to see your reflected image on the glass window of a lighted room at night when the outside is dark than seeing your reflected image in daytime. **Explain.**

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Answers of Test 1

1 (b) 2 (d) 3 (a)

4 (b) 5 (b) 6 (b)

7 (d) 8 (b) 9 (c)

10 $\because {}_1n_2 = \frac{\sin \phi_1}{\sin \theta_1}$,

$\because \theta_1 + \phi_2 = 90° \ , \phi_1 = \phi_2$

$\therefore \frac{n_2}{n_1} = \frac{\sin \phi_1}{\sin (90 - \phi_1)} = \frac{\sin \phi_1}{\cos \phi_1}$

$\therefore \tan \phi_1 = 1.33 \quad , \quad \phi_1 = 53°$

$\therefore \theta_1 = 90 - 53 = 37°$

11 Because the range of wavelengths of visible light extends from 400 nm to 700 nm which are very small wavelengths so that light diffraction doesn't appear because visible light needs very small aperture sizes for the appearance of light diffraction patterns.

12 $v_A = v_B = \frac{d}{t} = \frac{60 \times 10^{-2}}{0.3 \times 10^{-3}} = 2 \times 10^3$ m/s

Another Solution :

$\lambda_A = \frac{X}{N_A} = \frac{60 \times 10^{-2}}{0.75} = 0.8$ m

$\upsilon_A = \frac{1}{T_A} = \frac{1}{0.4 \times 10^{-3}} = 2.5 \times 10^3$ Hz

$v_A = \lambda_A \upsilon_A = 0.8 \times 2.5 \times 10^3 = 2 \times 10^3$ m/s

$\lambda_B = \frac{X}{N_B} = \frac{60 \times 10^{-2}}{1.5} = 0.4$ m

$\upsilon_B = \frac{1}{T_B} = \frac{1}{0.2 \times 10^{-3}} = 5 \times 10^3$ Hz

$v_B = \lambda_B \upsilon_B = 0.4 \times 5 \times 10^3 = 2 \times 10^3$ m/s

Answers of Test 2

1 (a) 2 (c) 3 (a)

4 (c) 5 (b) 6 (c)

7 (d) 8 (c) 9 (d)

10 $\because \Delta y = \frac{\lambda R}{d}$

$\because$ The used wavelength in the three cases is the same

$\therefore \Delta y \propto \frac{R}{d}$

$\therefore (\Delta y)_A : (\Delta y)_B : (\Delta y)_C$

$= \frac{0.6}{0.15} : \frac{0.8}{0.175} : \frac{0.8}{0.15}$

$= 1 : 1.14 : 1.33$

$\therefore (\Delta y)_C > (\Delta y)_B > (\Delta y)_A$

11 (a) $A = \frac{60 - 10}{2} = 25$ cm

(b) $s = N_{vibrations} \times 4A$

$= 2 \times 4 \times 25 = 200$ cm

12 Because when the outside is dark, the amount of light passing from the outside is very small, so the person can see his image as a result of the reflection of the small amount of light reflected by the glass of the room's window and when there is light outside, the amount of light passing from outside is larger than the amount of the reflected light, so it is difficult for the person to see his image.

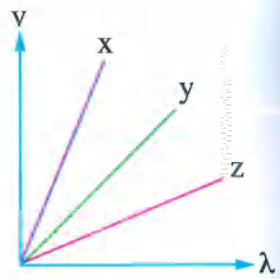
Test 1 For the first month

Choose the correct answer (1 : 9) :

1 A light ray is incident on a mirror where it makes an angle of 30° with it, so the angle between the incident and the reflected rays is equal to ..... .

(a) 20° (b) 60° (c) 120° (d) 150°

2 The opposite graph represents the relation between the speed (v) and the wavelength (λ) for three waves x, y, z when they propagate in three different media, so the correct order for the periodic time for the waves is .....



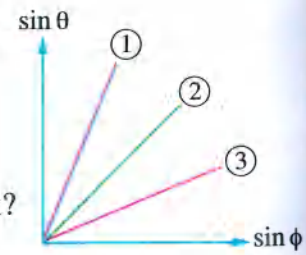
(a) $T_x > T_y > T_z$ (b) $T_z > T_x > T_y$

(c) $T_z > T_y > T_x$ (d) $T_x > T_z > T_y$

3 When using two different light sources the ratio between their wavelengths $\left(\frac{\lambda_1}{\lambda_2} = \frac{7}{8}\right)$ in Young's double slit experiment, the ratio between the distance between the centers of two successive fringes of the same type in the two cases $\left(\frac{\Delta y_1}{\Delta y_2}\right)$ will be ..... .

(a) $\frac{7}{8}$ (b) $\frac{8}{7}$ (c) $\frac{49}{64}$ (d) $\frac{64}{49}$

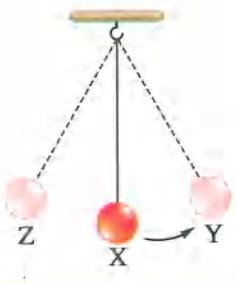
4 A light beam transfers from air to three different media ①, ② and ③ one at a time and the opposite graph represents the relation between sine of the angle of refraction (sin θ) for the light ray in each medium and sine of the angle of incidence (sin ϕ) for the beam, which of the three media has the highest refractive index?



(a) Medium ① (b) Medium ②

(c) Medium ③ (d) The three media have the same refractive index.

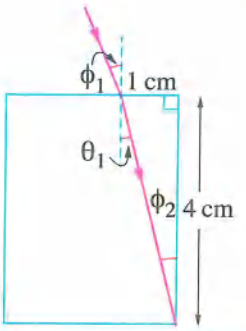
5 In the opposite figure, a simple pendulum moves a simple harmonic motion of periodic time T where it starts its motion from point X in the direction of point Y, so the point at which the pendulum bob be after a time 1.75 T is ..... .



(a) point X (b) point Y

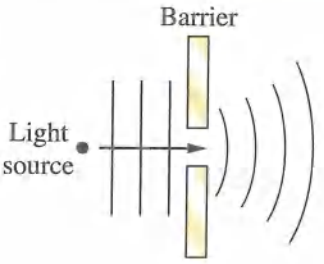
(c) point Z (d) between the two points X, Y

6 A light ray transfers from air to a medium of absolute refractive index 1.6 as in the opposite figure, so the angle of the incidence (ϕ_1) of the ray equals..... .



(a) 15.2° (b) 22.8°
(c) 28.5° (d) 34.2°

7 The opposite figure represents the diffraction phenomenon for a light ray of wavelength (λ) and frequency (υ) passing through a slit of width d in a barrier, so to make the diffraction more clear, we have to ..... .

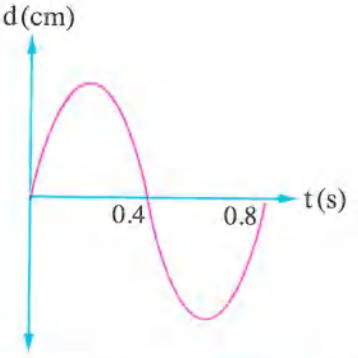


(a) use a light of frequency less than υ
(b) use a light of wavelength less than λ
(c) use a barrier with a slit of width larger than d
(d) increase the distance between the light source and the barrier

8 If the speeds of light in two media are 3×10^8 m/s, 2×10^8 m/s, so the relative refractive index from the optically rarer medium to the optically denser medium equals ..... .

(a) 0.67 (b) 0.83 (c) 1.2 (d) 1.5

9 The opposite graph represents the relation between displacement (d) of one of the molecules of a medium through which a transverse wave is propagating with a speed of 20 m/s and time (t), so the wavelength of that wave equals ..... .



(a) 4 m (b) 8 m
(c) 16 m (d) 25 m

Answer the following questions (10 : 12) :

10 **Give reason for:** When a light ray gets incident perpendicularly on a reflecting surface it reflects on itself.

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11 In Young's double slit experiment, a laser ray of wavelength 575 nm is used where the screen on which the fringes are received is placed at a distance of 0.9 m from the barrier of the double slits, so the center of the first bright fringe becomes at 2.75 mm from the center of the central fringe. **Calculate** the distance between the slits.

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12 A load got suspended by a spring coil, so the length of the coil became 7 cm, and when the load gets pulled vertically downwards by a certain force, the length of the coil becomes 10 cm. If the load is left to vibrate, **calculate** the distance covered by the load through five complete vibrations.

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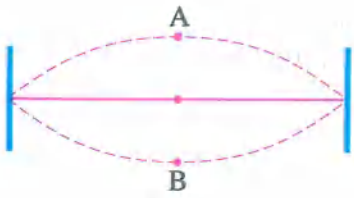
Test 2 For the first month

Choose the correct answer (1 : 9) :

1. The opposite figure shows a vibrating string, if the required time for the string to move from point A to point B is 0.005 s, then the frequency of the string is ..... .



(a) 20 Hz (b) 50 Hz
(c) 100 Hz (d) 200 Hz

2. In Young's double slit experiment, the fringe that is formed due to superposition of two waves between which the path difference is zero will be the ..... fringe.

(a) central (b) first bright
(c) first dark (d) second bright

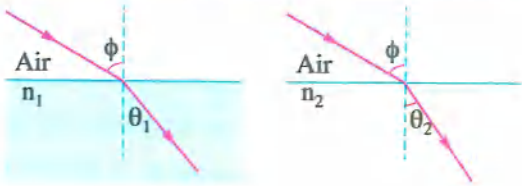
3. A light ray of speed c gets incident on a mirror, so it gets reflected with a speed ..... .

(a) c (b) greater than c
(c) less than c (d) the answer is indeterminable

4. When a wave transfers between two different media, which of the following do not get altered for that wave ?

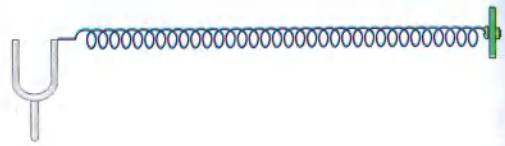
(a) The speed and the frequency (b) The wavelength and the periodic time
(c) The speed and the wavelength (d) The frequency and the periodic time

5. The opposite figure represents two light rays incident from air, with equal angles on two different media, of refractive indices n_1, n_2, so if $\theta_1 > \theta_2$, then ..... .



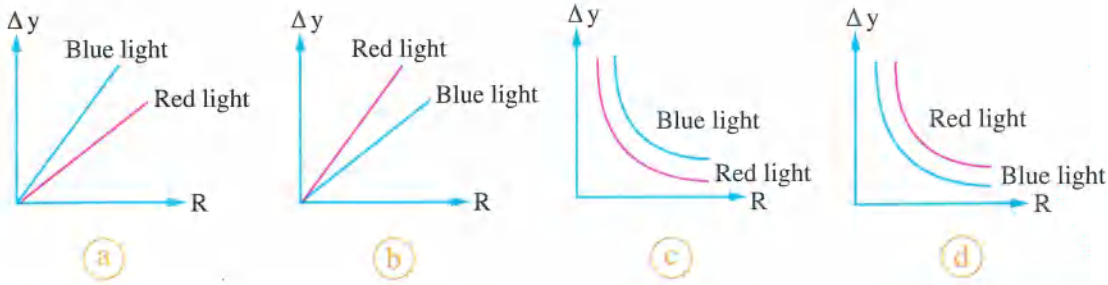
(a) $n_1 > n_2$
(b) $n_1 = n_2$
(c) $n_1 < n_2$
(d) the answer is indeterminable

6 What's the type of the wave that will be formed in the spring coil and in the air when the two branches of the tuning fork in the opposite figure vibrate?

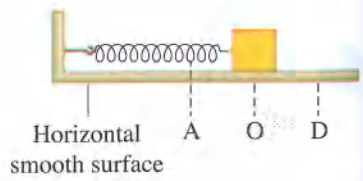


	In the spring coil	In air
(a)	Longitudinal	Transverse
(b)	Longitudinal	Longitudinal
(c)	Transverse	Transverse
(d)	Transverse	Longitudinal

7 Young's double slit experiment is conducted two times, the first using red light and the second using blue light. In each time, the distance between the double slit and the fringes' receiving screen is changed many times. So, which of the following figures represents the graph of the distance between the centers of two successive dark fringes (Δy) versus the distance between the double-slit barrier and the fringes receiving screen (R)?



8 The opposite figure represents a load attached to one of the ends of a spring and moves in a simple harmonic motion between two points A, D Which of the following quantities becomes minimum when the object becomes at point O?



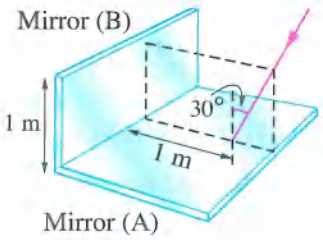
(a) Speed of the object.

(b) Elastic potential energy of the object.

(c) Kinetic energy of the object.

(d) Mechanical energy of the object.

9 The opposite figure illustrates two perpendicular plane mirrors A and B, where a light ray gets incident on mirror A with an angle of incidence 30°, so the ray ..... .



(a) gets incident on mirror B with an angle of incidence 30°

(b) gets incident on mirror B with an angle of incidence 60°

(c) gets reflected on mirror B with an angle of incidence 45°

(d) does not get incident on mirror B

Answer the following questions (10 : 12) :

10 The opposite figure represents bright and dark fringes that are formed due to one of the physical phenomena of light.
What is this phenomenon? **And why**?

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11 A spring coil is moved in a way to make a wave of wavelength 120 cm and periodic time of 0.4 s, then it is moved in a different way to make a wave of wavelength 210 cm that has the same speed of the first wave, **calculate** the periodic time of the second wave.

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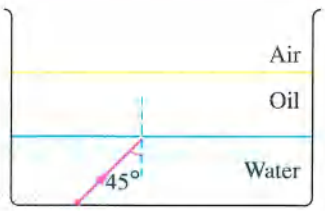
12 In the opposite figure, a point light source is placed in water from which a light ray gets incident by angle 45° on the boundary surface between water and oil.
If the absolute refractive index of water is $\frac{4}{3}$ and the absolute refractive index of oil is 1.8,
then calculate angle of refraction of the light ray in air.



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Answer of Test 1 on the 1st Month

1. (c) 120°
2. (c) $T_z > T_y > T_x$
3. (a) $\frac{7}{8}$
4. (c) Medium (3)
5. (c) point Z
6. (b) 22.8°
7. (a) use a light of frequency less than υ
8. (d) 1.5
9. (c) 16 m
10. Because when the light ray gets incident perpendicularly on the reflecting surface, the angle of incidence equals zero and since the angle of incidence is equal to the angle of reflection, the angle of reflection equals zero so the ray reflects on itself.
11. $\because \Delta y = \frac{\lambda R}{d}$

$$\therefore d = \frac{\lambda R}{\Delta y} = \frac{575 \times 10^{-9} \times 0.9}{2.75 \times 10^{-3}}$$

$$= 1.88 \times 10^{-4} \text{ m}$$

12. - The amplitude (A) :

$$A = 10 - 7 = 3 \text{ cm}$$

- The distance moved by the load (S):

$$s = 5\, s_{\text{one vibration}}$$

$$= 5 \times 4\, A$$

$$= 5 \times 4 \times 3 = 60 \text{ cm}$$

Answer of Test 2 on the 1st Month

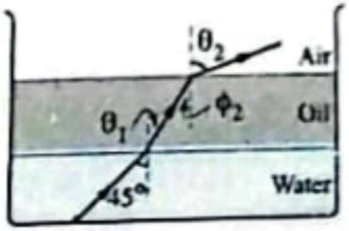
1. ⓒ 100 Hz
2. ⓐ central
3. ⓐ c
4. ⓓ The frequency and the periodic time
5. ⓒ $n_1 < n_2$
6. ⓑ Longitudinal, Longitudinal
7. ⓑ
8. ⓑ Elastic potential energy of the object.
9. ⓓ does not get incident on mirror B
10. The phenomenon is the diffraction of light where the central fringe is wide and its brightness is higher than that of the other bright fringes, where the brightness of the fringes decreases as we go away from the central fringe and also the width of the fringes is not the same.
11. $\because \upsilon_1 = \upsilon_2$

$\therefore \lambda_1 \upsilon_1 = \lambda_2 \upsilon_2$

$\therefore \frac{\lambda_1}{T_1} = \frac{\lambda_2}{T_2}$, $\frac{120}{0.4} = \frac{210}{T_2}$

$\therefore T_2 = 0.7$ s

12. By applying Snell's law at the boundary surface between water and oil:



$n_{water} \sin \phi_1 = n_{oil} \sin \theta_1$

By applying Snell's law at the boundary surface between oil and air:

$n_{oil} \sin \phi_2 = n_{air} \sin \theta_2$

$\because \phi_2 = \theta_1$ (Alternate angles)

$\therefore n_{oil} \sin \phi_2 = n_{oil} \sin \theta_1$

$\therefore n_{air} \sin \theta_2 = n_{water} \sin \phi_1$

$\sin \theta_2 = \frac{4}{3} \sin 45$

$\theta_2 = 70.6°$

Important physical and mathematical basics:

1-some unit's conversion:

Factor	10^{-9}	10^{-6}	10^{-3}	10^{-2}	10^{3}	10^{6}	10^{9}
Prefix	nano	Micro	Milli	Centi	Kilo	Mega	Giga
Symbol	n	μ	m	c	K	M	G

- **Area**

$cm^2 \xrightarrow{10^{-4}} m^2$

$mm^2 \xrightarrow{10^{-6}} m^2$

- **Volume**

$cm^3 \xrightarrow{10^{-6}} m^3$

$mm^3 \xrightarrow{10^{-9}} m^3$

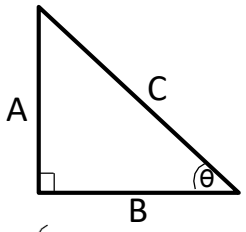
$cm^3 \xrightarrow{10^{-3}} Liter$

$Liter \xrightarrow{10^{-3}} m^3$

- **Pythagoras theorem**

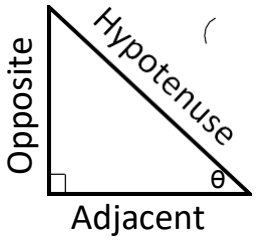
In the right angle triangle the square of hypotenuse is equal to the sum of squares of the other two sides

i.e $C^2 = A^2 + B^2$ **so** $C = \sqrt{A^2 + B^2}$



$\text{Sin}\,\theta = \frac{Opposite}{Hypotenuse}$, $\text{Cos}\,\theta = \frac{Adjacent}{Hypotenuse}$

$\text{Tan}\,\theta = \frac{Opposite}{adjacent}$



Unit One

Chapter 1: Wave motion

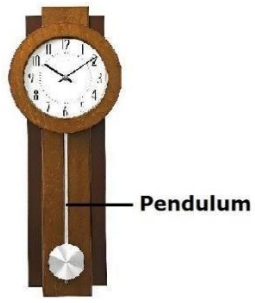
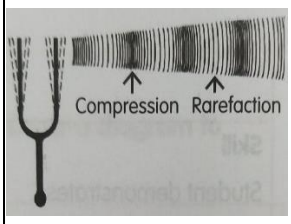
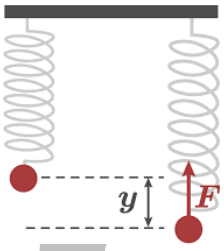
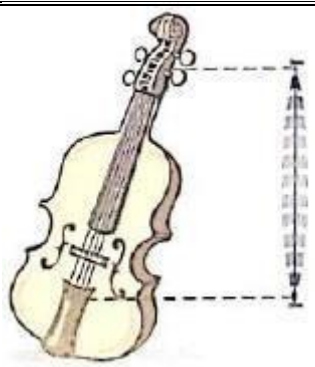
Lesson 1: Oscillatory motion

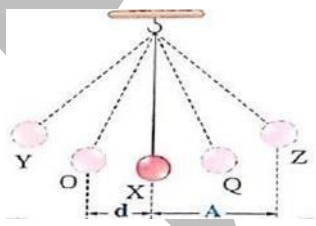
You have studied that motion can be classified into two types :

Translation motion	**Periodic motion**

Oscillatory motion:

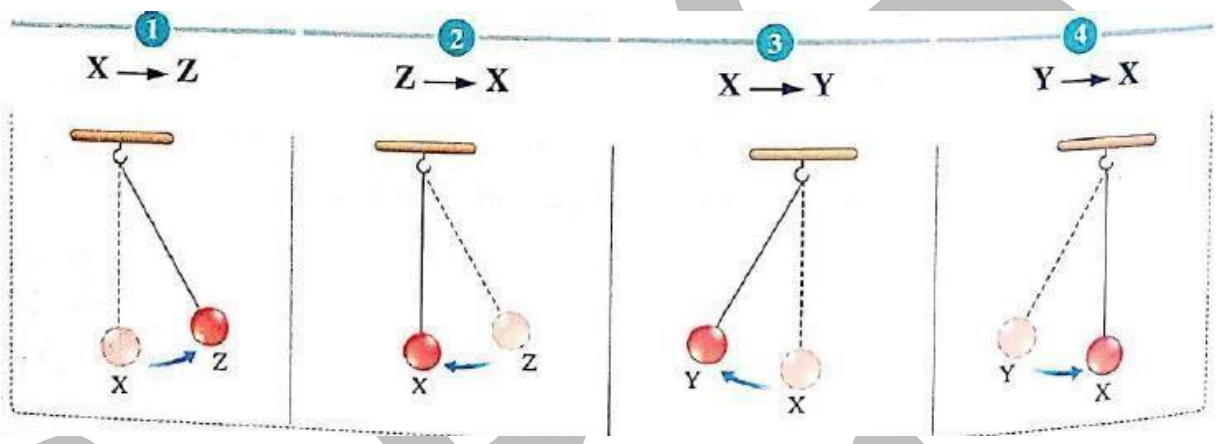
It is the motion of a vibrating body about its rest position or its equilibrium position that gets repeated through equal intervals of time.

			
Simple pendulum (Clock pendulum)	Vibrating tuning fork	Plumb or bob suspended to a spring (yoyo)	Vibrating string Violin strings

The diffrence between Displacement & Amplitude	
	
1) Displacement	**2) Amplitude**

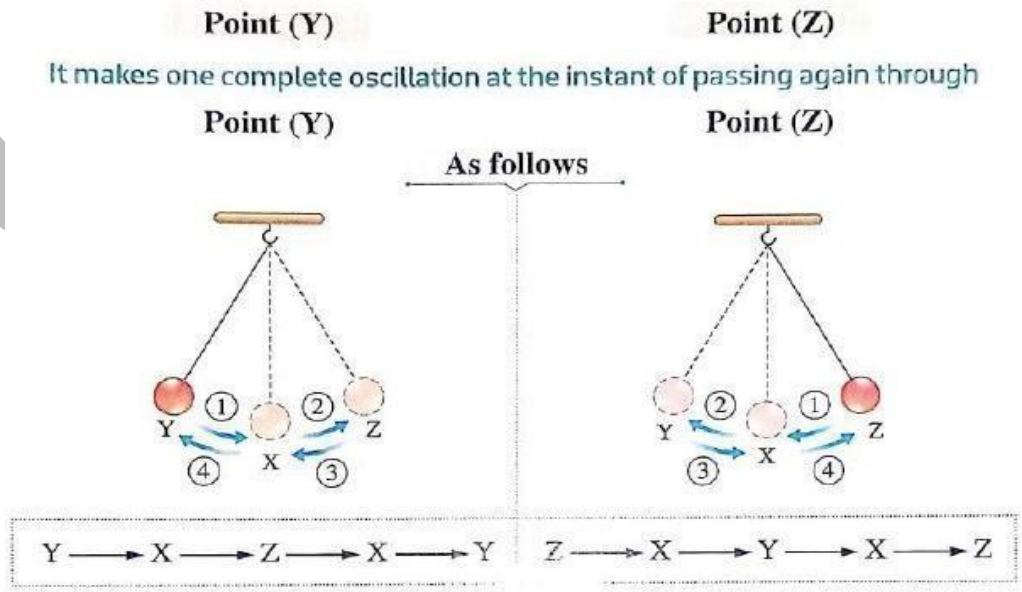
3) Complete oscillation

When observing the motion of the pendulum bob starting from point X in a certain direction until it returns back to the same point again moving in the same direction, so the pendulum has made a complete oscillation where its path of motion can be represented as follows:



Hence, the pendulum bob passes by point X two successive times in the same direction with the same velocity, i.e. **(body has the same phase)**.

If the motion of the body has been observed starting from:



- **Complete Oscillation:**

It is the motion of an oscillating body during a period of time when it passes through a certain point in its path of motion two successive times in the same direction.

	The periodic time (T)	The frequency (P)
Definition		
Mathematical Relation		
The measuring Unit		

The graphically representation between (N) Vs (T)

The graphically representation between (P) vs (T) & $(\frac{1}{T})$

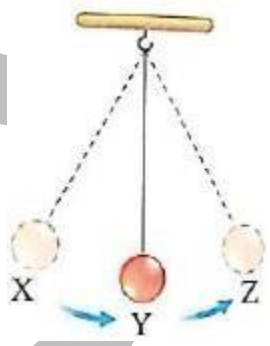
Simple harmonic motion (SHM)

Simple harmonic motion is a type of periodic motion such as the motion of a simple pendulum or a body fixed to a spring coil which can be represented by a sinusoidal curve (sine wave).

Example 1: In the opposite figure: If the time taken by the pendulum to move from X to Z is 0.8 s, calculate:

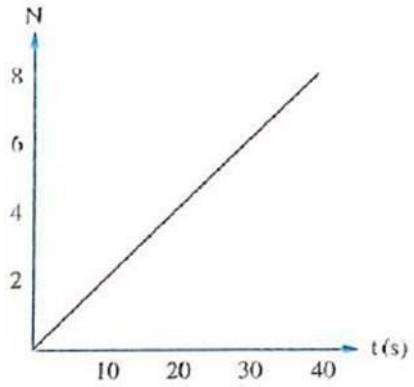
(a) The periodic time.
(b) The frequency.
(c) The number of complete oscillations through 16 s.
(d)The time required to make 50 oscillations.

Solution:



Example 2:

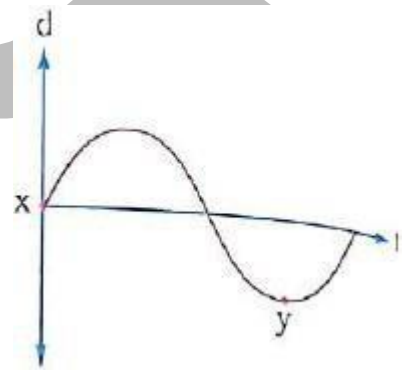
The opposite graph represents the relation between the number of complete oscillations (N) and the time (t), then the frequency of motion of this body equals .....

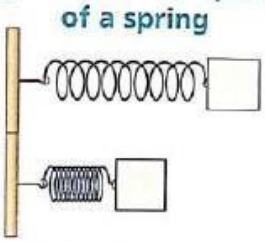
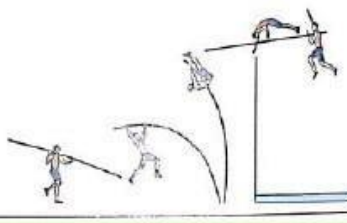


Solution:

Example 4:

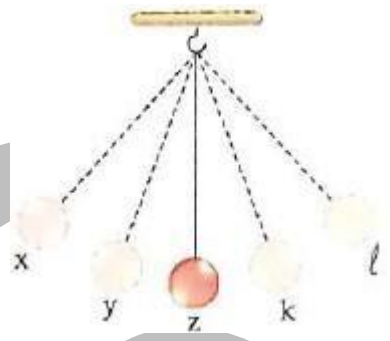
The opposite graph represents the relation between the displacement (d) and the time (t) for a mass tied to a spring and vibrating with frequency 60 Hz, then the time taken by the mass to pass between the two points x, y is ……



	The concept		Example
1	**Kinetic energy** → $KE = \frac{1}{2}mv^2$	The energy possessed by the body due to its motion	A running man 
2	**Potential energy** → $PE = mgh$	The energy stored in the body due to its state or position	Elongation and compression of a spring 
3	**Mechanical energy** → $E = PE + KE$	The summation of the potential energy and the kinetic energy of the body	Pole vault 

Example 5:

The opposite figure shows the motion of a simple pendulum where xy = yz = zk = kl. If the pendulum takes time (t) to move from x to y. the periodic time is.....



a) 8t b) less than 8t

c) greater than 8t d) indeterminable

Exercise 1

Choose the correct answer:

1) The motion of a body in a circular path with a constant speed is considered.....

(a) a periodic motion (b) a simple harmonic motion

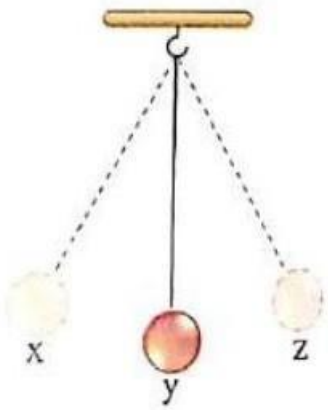
(c) an oscillatory motion (d) a wave motion

2) The motion of a swing is considered.....

(a) a translational motion (b) a wave motion

(c) an oscillatory motion (d) a circular motion

3) In the opposite figure, the pendulum makes a complete oscillation when it moves from .....



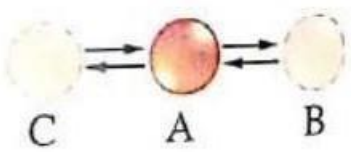
(a) x ⟶ y

(b) x ⟶ y ⟶ z

(c) x ⟶ y ⟶ z ⟶ y

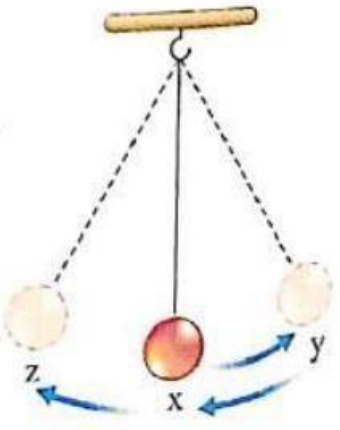
(d) x ⟶ y ⟶ z ⟶ y ⟶ x

4) In the opposite figure, a body moves in an oscillatory motion, so the distance which is moved by the body during a complete oscillation equals .....



(a) double the distance AB.
(b) half the distance AC.
(c) double the distance BC.
(d) four times the distance BC.

5) The opposite figure shows a simple pendulum vibrating with an amplitude.
A. If its bob has moved from position x to position y and then to position z, the magnitude of displacement of the pendulum bob equals……

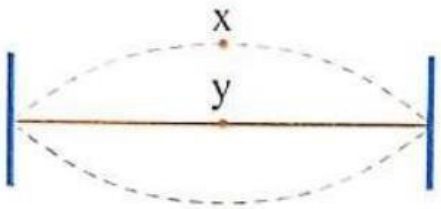


(a) A
(b) 2A
(c) 3A
(d) zero

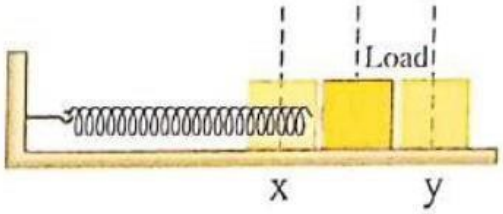
6)In an oscillatory motion, the ratio between the time of an amplitude and the time of a complete oscillation is…….

(a) 2 (b) $\frac{1}{2}$ (c) 4 (d) $\frac{1}{4}$

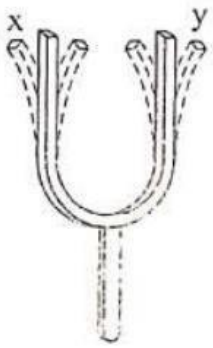
7)In which of the following figures is the distance between the two positions x, y representing the amplitude of vibration?



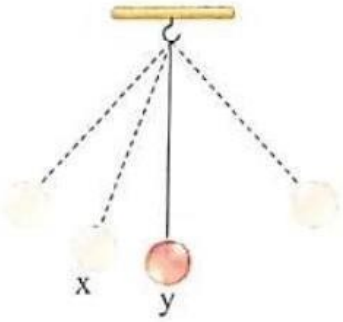
(a)



(b)



(c)



(d)

8) The opposite figure shows a string vibrating with a periodic time T, so the time taken by the string reaches the maximum displacement from its equilibrium position is .....

(a) T/4 (b) T/3 (c) T/2 (d) T

9)The periodic time of an oscillating simple pendulum is the time taken by the pendulum bob to pass two successive times through a point in its path when this point is…….

(a) at the equilibrium position.

(b) at the maximum displacement away from the equilibrium position.

(c)between the equilibrium position and the maximum displacement in the positive direction.

(d)between the equilibrium position and the maximum displacement in the negative direction.

10) The opposite figure shows a person measuring his pulse rate which is found to be 75 beats per minute.

What is the frequency and the periodic time of his heart muscle motion?

	The frequency	The periodic time
a	0.8 Hz	0.8 s
b	0.8 Hz	1.25 s
c	1.25 Hz	0.8 s
d	1.25 Hz	1.25 s

Lesson 2: Wave motion

What Happens when a stone is dropped in a lake?

The wave:

It is a disturbance that propagates and transfers energy in the

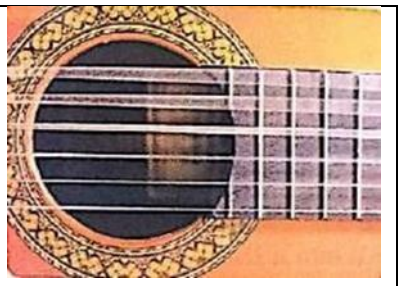
Types of waves:

1. Mechanical waves
2. Electromagnetic waves

First Mechanical waves:

Mechanical waves are produced due to the vibration of a body in a medium, so the vibration (disturbance) propagates from the body through the medium.

- Source: They need a medium through which they can propagate.
- Examples:

		
Water waves	Sound waves	Waves that propagate in strings during their vibrations

- Conditions of obtaining mechanical waves:

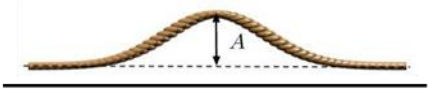
1 The existence of a vibrating source
2 The occurrence of a disturbance that transfer from the source to the medium
3 The existence of a medium to transmit the disturbance

Note:
Since sound is a mechanical wave, it cannot propagate in empty space, so:
-The sounds of cosmic explosions that happen in the outer space cannot be heard.
- Astronauts use wireless devices to communicate in space.

Types of Mechanical waves:

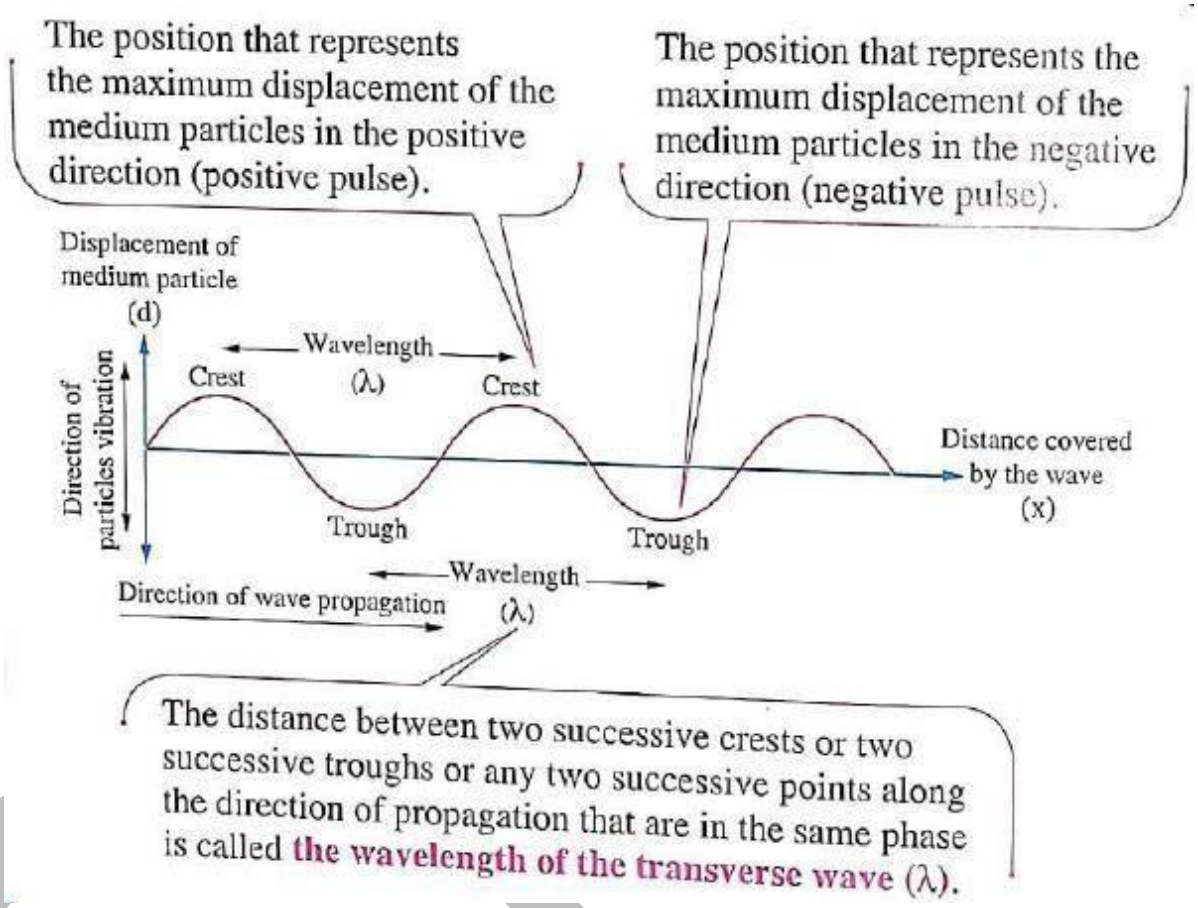
1- Transverse waves 2- Longitudinal waves

(1) transverse wave: It is a wave in which the directions of medium particles vibrations about their equilibrium positions are perpendicular to the direction of wave propagation.

A pulse: Is a single disturbance in a form of half wave	

Note that:

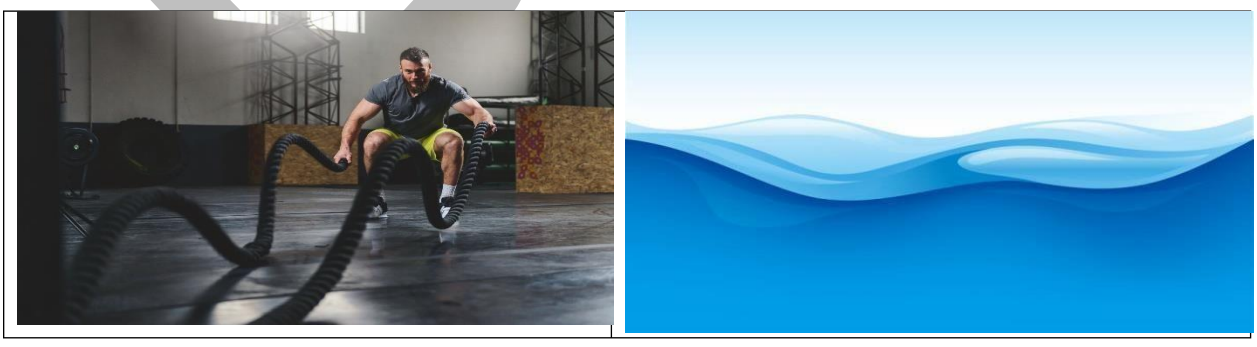
The distance between two successive crests or two successive troughs or any two successive points along the direction of propagation that are in the same phase is called the wavelength of the transverse wave (λ).



Notice that:

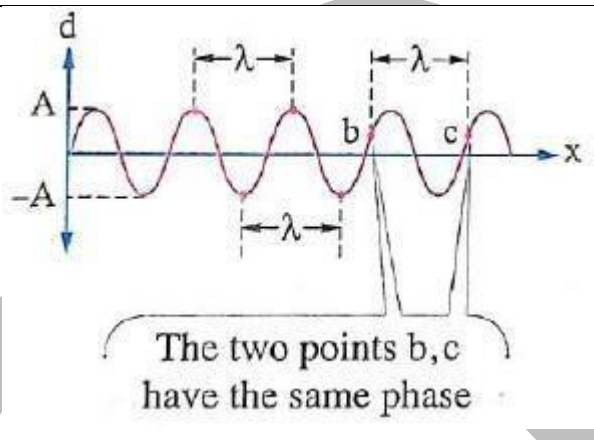
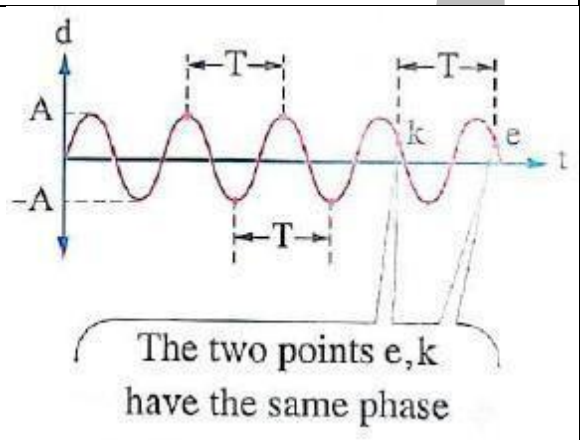
A medium particle has the same phase at a definite position, when it passes through that position two successive times with the same velocity (including magnitude & direction).

Examples of transverse waves:



Graphical representation of transverse waves:

The motion of the particles of the medium in which the transverse wave propagates can be represented through the graphs of:

The displacement of the particles of the medium (d) versus the horizontal distance (x) covered by the wave at a certain instant.	The displacement of one of the medium particles (d) versus time (t).
We get a sine curve	
	
From the two graphs, we find	
Wave length (λ)= $\frac{x\,(\boldsymbol{Total\ distance})}{N(\boldsymbol{Number\ of\ waves})}$	Frequency(P) = $\frac{N(\boldsymbol{Number\ of\ waves})}{t(\boldsymbol{Time\ in\ seconds})}$ Frequency(P) = $\frac{1}{T}$

From the previous, we can define the wave amplitude (A) as follows:

The wave amplitude (A):

It is the maximum displacement of the vibrating medium particles away from their equilibrium positions.

Example 1:

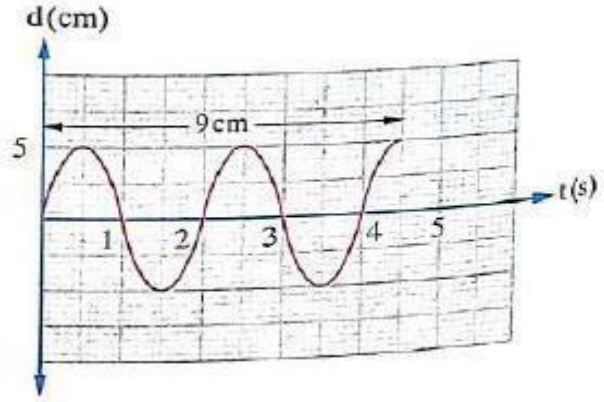
The opposite graph represents a transverse wave, calculate:

a) the amplitude

b) the frequency

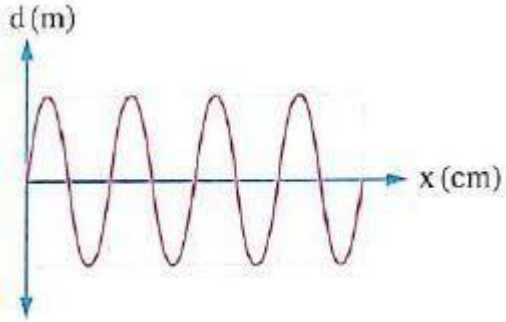
C) The periodic time

d) the wave length



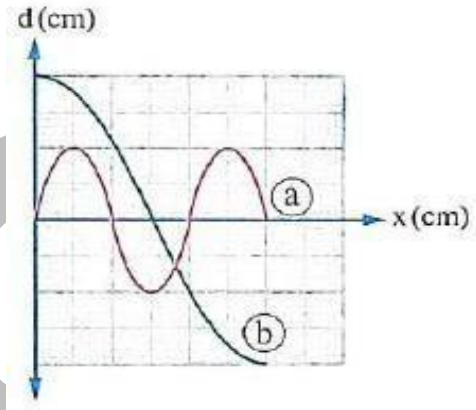
Solution:

The opposite graph represents the relation between the displacement (d) of the medium particles and the distance (x) travelled by two transverse waves is travelling at a certain instance and the distance (x) travelled by the wave, if the distance between the first trough and the seventh crest is 5.5 cm, the wavelength of the wave equals?



Example 3:

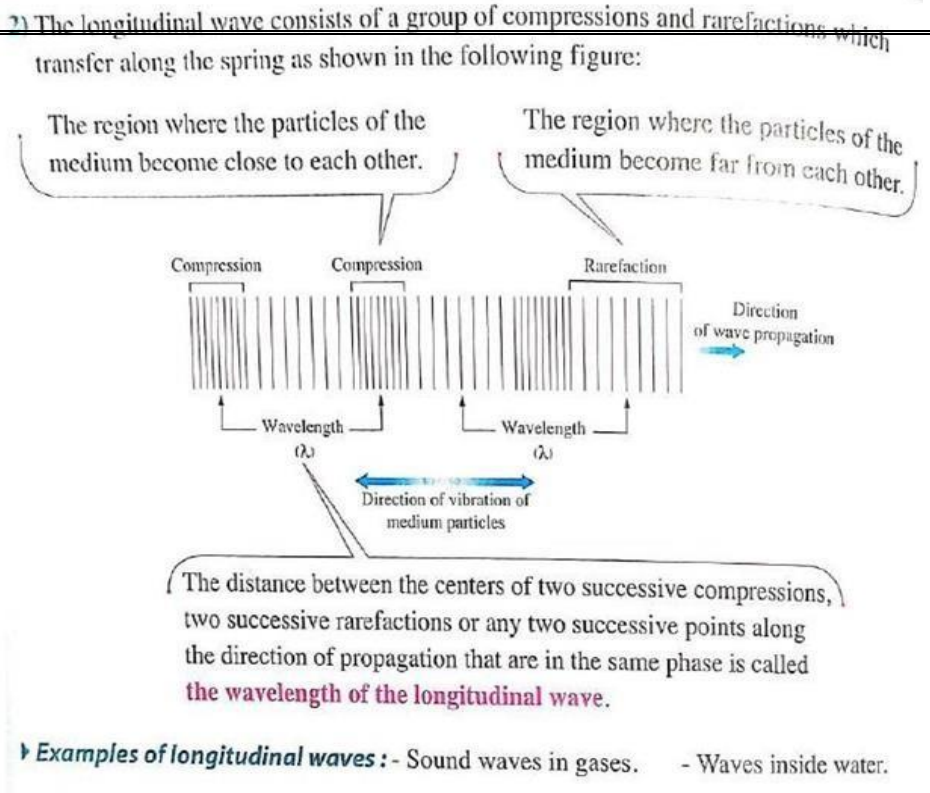
The opposite graph represents the relation between the displacement (d) of the medium particles and the distance (x) travelled by two transverse waves (a),(b), so the ratio between their wavelengths $(\frac{\lambda a}{\lambda b})$ equals?



2- Longitudinal waves:

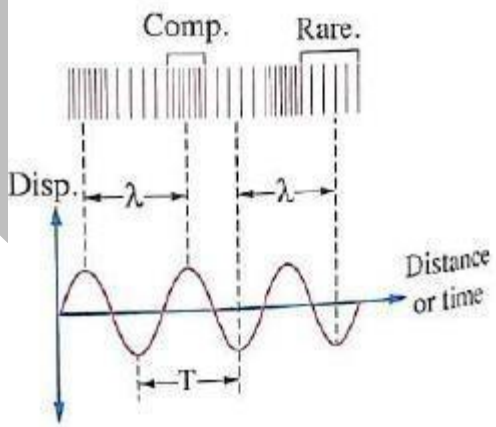
To describe the nature of longitudinal waves, we carry out the following experiment:

2) The longitudinal wave consists of a group of compressions and rarefactions which, transfer along the spring as shown in the following figure:



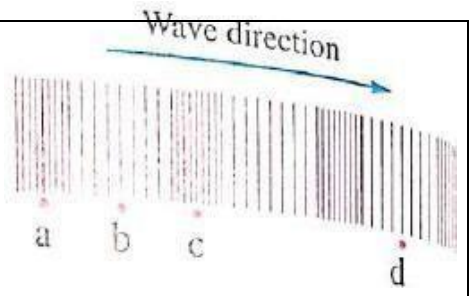
The graphical representation of longitudinal waves:

When we plot the relation between the displacement of the medium particles and the distance travelled by the wave at a certain instant or between the displacement and the time for the motion of the medium particles in which the longitudinal wave propagates, we get a sine wave curve as shown in the opposite figure, hence all the concepts and the laws of the transverse wave are applicable to this curve.



From the previous, we can compare between the two types of mechanical waves (Transverse & longitudinal) as follows:

Example 4:



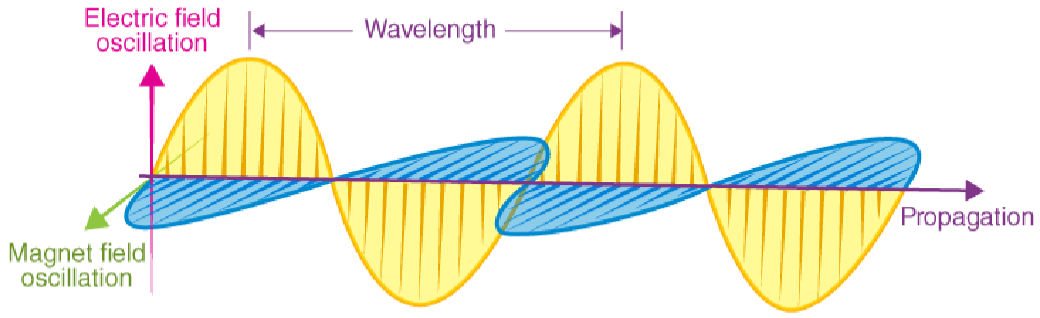
The opposite figure represents a longitudinal wave. If the distance between the two points a and b is I.7 m and the time:

taken by the wave to travel from c to d is 0.015 s. calculate

(a) The wavelength of the longitudinal wave.

(b) The frequency of the wave.

Second: Electromagnetic waves:

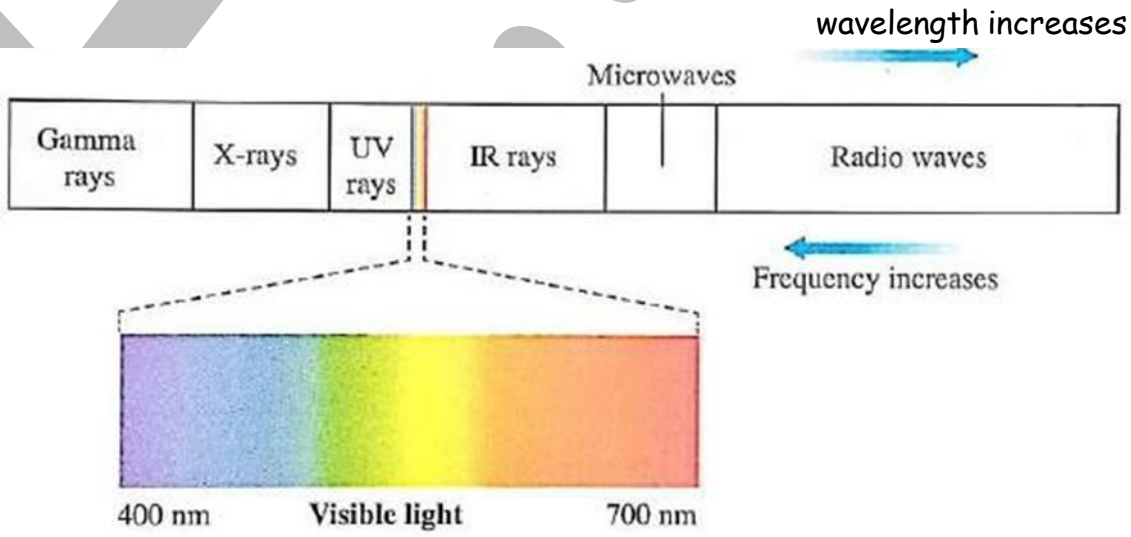


Concept: They are waves that originate from the vibration of electric and magnetic fields with the same frequency where both fields are in the same phase perpendicular to each other and to the direction of their propagation.

Propagation: They travel either in physical media or in empty space where their speed in space reaches its maximum constant value that equals 3×10^8 m/s.

Types: Transverse waves only.

Electromagnetic spectrum:



From the previous, we can compare between mechanical and electromagnetic waves as follows:

Deducing the speed of propagation of the waves:

• If a wave has travelled a distance x through a time interval t, the speed of the wave (v) is calculated from the relation v= $\frac{x}{t}$

So, if the distance equals its wavelength (λ) then the wave takes a time equals to the periodic time (T)

So $V = \frac{\lambda}{T}$

But $P = \frac{1}{T}$ SO $V = \lambda \vartheta$

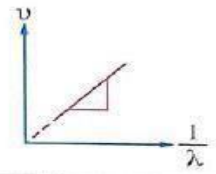
This equations is applicable to all types of waves (mechanical or electromagnetic)

The factors that affect the speed of wave in a medium:

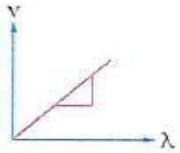
i.e.

- The wavelength is inversely proportional to the frequency (υ) at constant wave speed (v).
- The wavelength is directly proportional to the wave speed (v) at constant frequency (υ).

Graphical representation

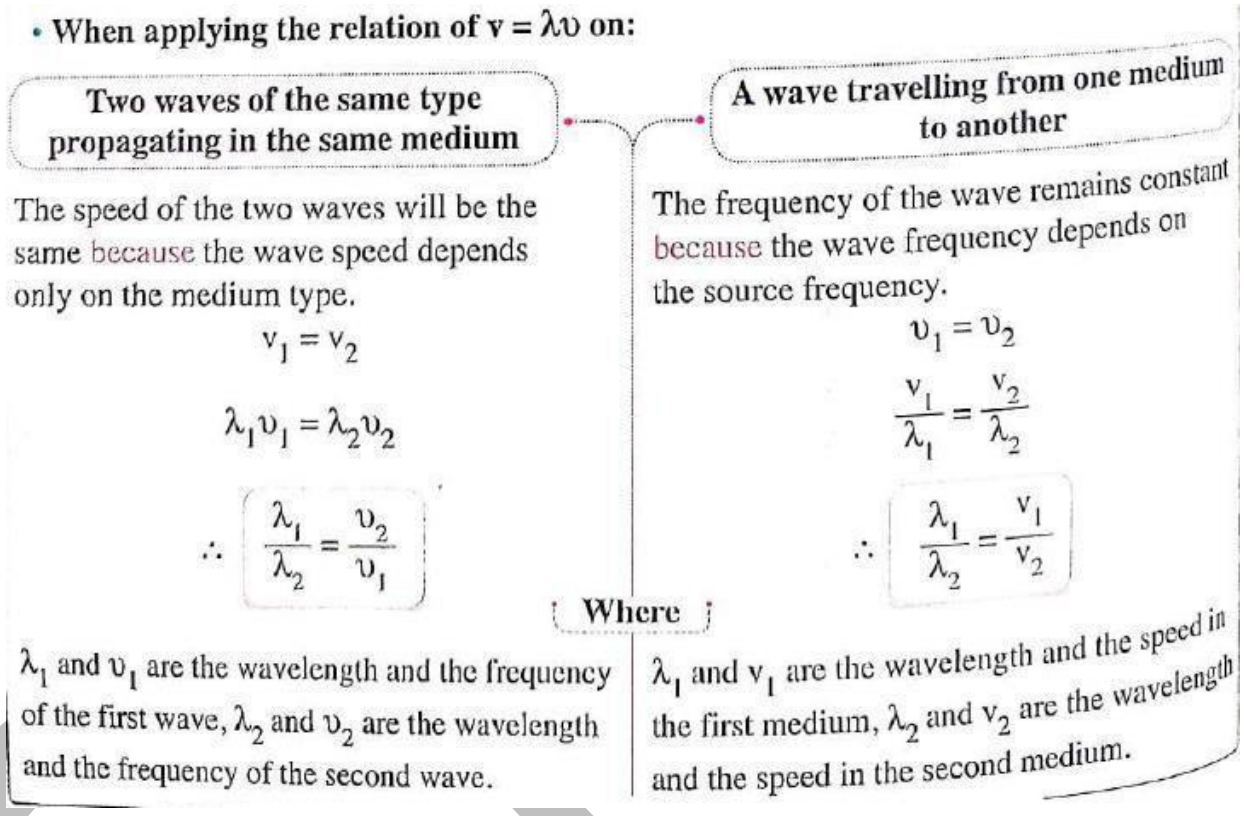


$$\text{Slope} = \frac{\Delta \upsilon}{\Delta (\frac{1}{\lambda})} = v$$



$$\text{Slope} = \frac{\Delta v}{\Delta \lambda} = \upsilon$$

Notes:



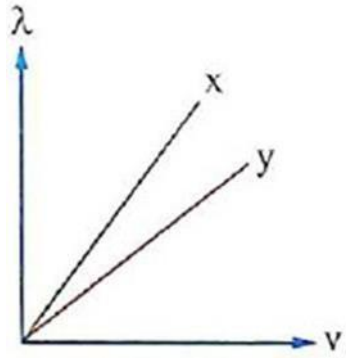
Example 5: A sound wave of wavelength λ propagates in air with a speed of330 mls, if it has travelled to another medium in which its speed is 990 mls, then its wavelength increases by .....

Example 4:

Two tones, whose frequencies are 340 Hz and 212Hz, travel in air. If the wavelength of one of them is longer than the other by 60 cm, then the speed of sound in air equals.....

a) 337.9 m/s b) 430 m/s c) 342.1 m/s d) 343.2 m/s

Example 5: The opposite graph represents the relation between the wavelength (λ) for two waves (x, y) propagating in different media and the speed (v) of these two waves in each of these media, so which of the following relations is correct?



a) Tx < Ty b) Tx > Ty c) Px > Py

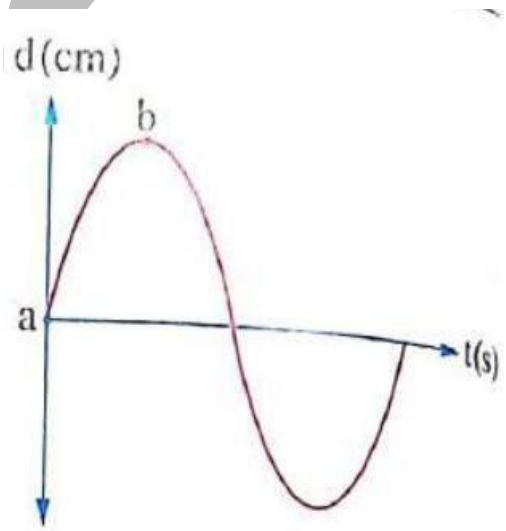
d) Px = Py

Solution:

Exercise2

Choose the correct answer:

1) The opposite figure represents the relation between the vertical displacement (d) of one of the medium particles and the time (t) for a transverse wave of frequency that equals 50 Hz, then the time interval taken by the medium particle to move between the two points a and b is……

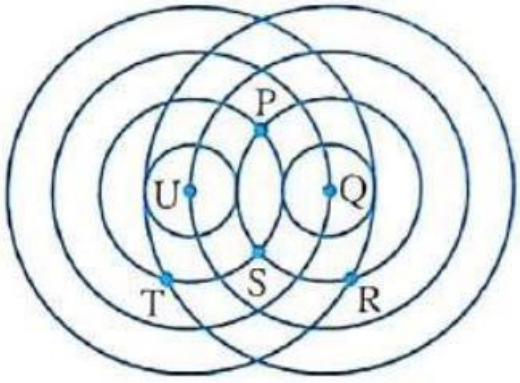


(a) 2/25 s (b) 1/25 s
(c) 1/50 s (d) 1/200 s

2) Waves transfer …… in the direction of their propagation.

(a) matter (b) particles c) energy d) water

3) Two waves interfere on the surface of the water as shown in the opposite figure, which two points in the figure represent the sources of these waves?



(a) P, S (b) T, R
(c) Q, T (d) U, Q

4) The opposite figure shows a wave propagating on the surface of a still lake, so this wave propagates in .....

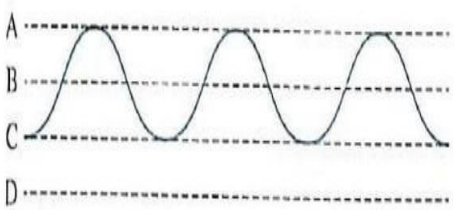
a) one direction with an increasing speed

b)Two opposite directions with two different speeds

c) all directions with the same speed

d) all directions with increasing speed

5) A train of waves passes on the water surface of a lake as shown in the opposite figure.



What will be the level at which the surface of water settles after the waves finish passing?

(a) A (b) B

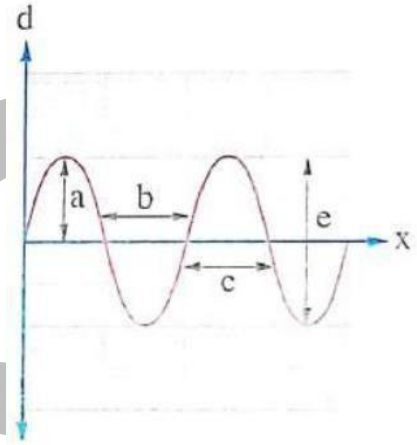
(c) C (d) D

6) In the opposite wave, which of the points a, b, c, and d have the same phase?

a) a, b, c b) a, b

c) b, c d) b, d

7) The opposite graph represents the relation between the displacement (d) of the particles of a medium in which a transverse wave propagates with frequency (P), amplitude A, and the distance (x) traveled by the wave, if:



(i) The frequency of the wave is doubled at constant amplitude, then distance……

(a) a increases to the double

(b) b increases to the double

(c) c decreases to its half

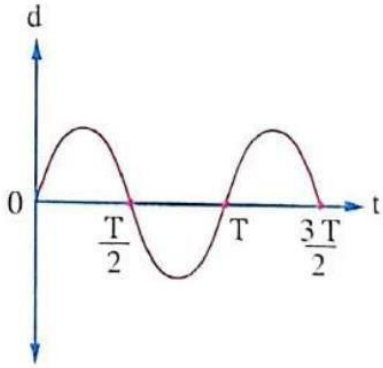
(d) e decreases to its half

ii) The amplitude of the wave is doubled at a constant frequency, then distance……..

(a) a decreases to its half (b) b decreases to its half

(c) c increases to the double (d) e increases to the double

8) A transverse wave propagates in a rope where the opposite graph of displacement (d) versus time (t) represents the motion of one of the rope particles, so what is the time required for this particle to return back to the same phase?



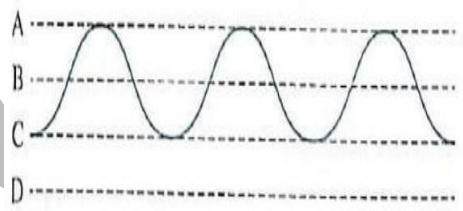
(a) T/2 (b) T/4

(c) T (d) 3/2 T

9)If the wavelength of a transverse wave is y, then the distance between the first crest and the crest of order n equals……..

(a) ny (b) (n + 1)y (c) (n -1) y (d) (n-1/2) y

10)In the opposite wave, if the distance between the first crest and the fifth trough is 140 cm, then the wavelength for this wave equals……



(a) 10 cm (b) 20 cm

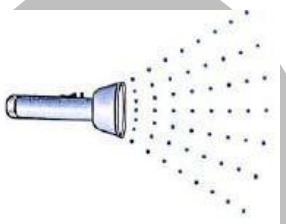
(c)40 cm (d) 70 cm

Chapter 2: Properties of light
(Propagation, Reflection & Refraction)

In the study of the nature of light, physicists were divided into two groups:

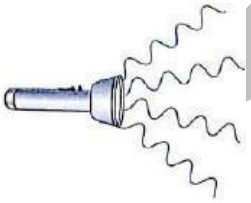
The first: (Isaac newton's idea)

Which considers light as very tiny particles.



The second: (Huygen's idea)

Which considers light as wave.



However, modern physics (quantum physics) has proven the principle of dual mature of light, which states that the electromagnetic radiation has:

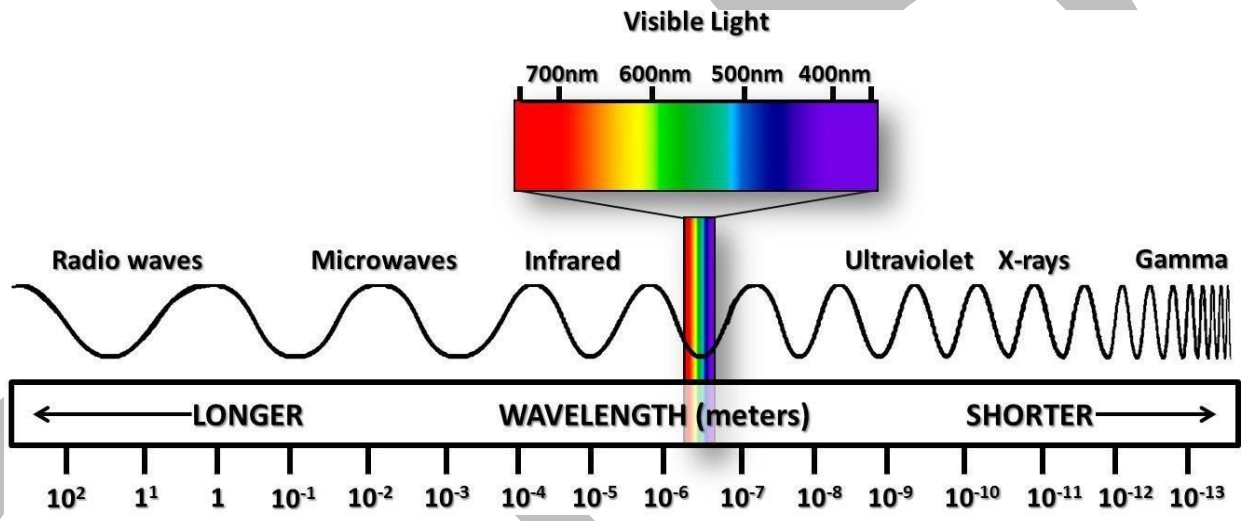
1- Wave nature: They are transverse electromagnetic waves.

2. Particle nature: They consist of energy quanta that have particle nature called photons.

Electromagnetic waves have an extensive range of frequencies and wavelength, this range is called:

The electromagnetic spectrum which includes:

Radio waves, Micro waves, Infrared, Visible light, Ultraviolet, X-rays & gamma rays

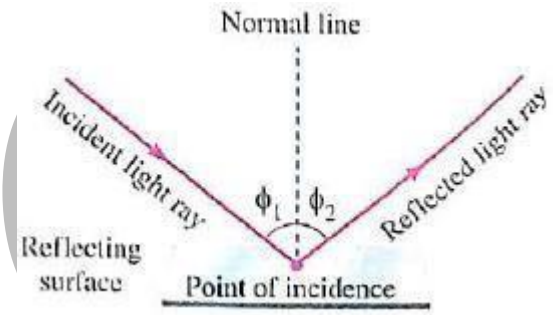


From the figure, it is clear that visible light is a limited part of the electromagnetic spectrum and in the following, we will study some of its properties:

1 Reflection
2 Refraction
3 Interference
4 Diffraction

first light reflection:

Occurrence: When light waves fall in a medium on a reflecting surface, they bounce back in the same medium and this phenomenon is known as **light reflection.**



Light reflection, angle of incidence and angle of reflection can be defined as follows:

1 Light reflection:

It is the bouncing of light waves in the same medium when they encounter a reflecting surface.

2 The angle of incidence:

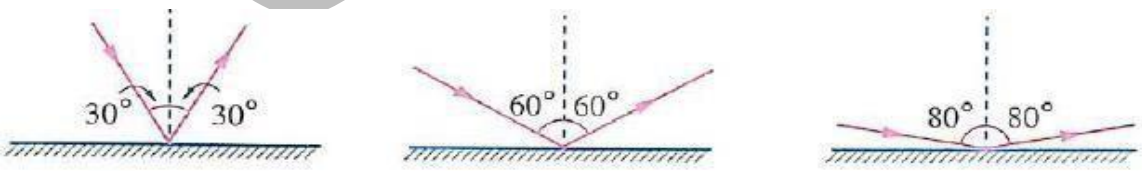
It is the angle between the **incident light** ray and the normal line on the reflecting surface at the point of incidence.

3 The angle of reflection:

It is the angle between the **reflected light** ray and the normal line on the reflecting surface at the point of incidence.

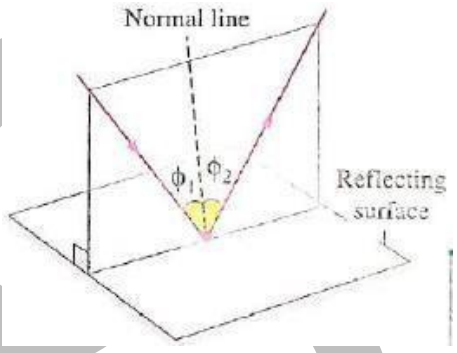
The reflection of light obeys two laws, which are:

1- Angle of incidence (=) Angle of reflection



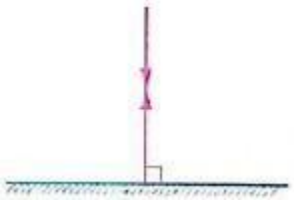
The second law:

The incident light ray, the reflected light ray and the normal line at the point of incidence all lie in the same plane which is perpendicular to the reflecting surface.

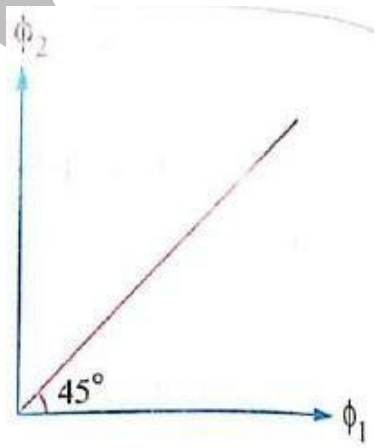


Notes:

2) The light ray which falls perpendicular to a reflecting surface gets reflected on itself Because the **angle of incidence equals** the **angle of reflection equal zero**



3) When plotting the relation between the angle of reflection (ø2) and the angle of incidence (ø1). we get a straight line and when the two axes have the same drawing scale, the straight line will make a 45° angle with the horizontal axis as in the opposite graph

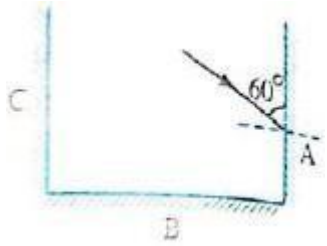


4) It is easier to see your reflected image on the glass window of a lighted room at night when the outside is dark than seeing your reflected image at daytime explain??

Because

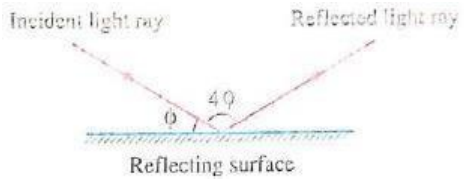
Example 1:

Three mirrors; A.B and C, are perpendicular to each other. If a light ray falls on mirror A as shown in the figure trace the path of the light ray until its reflection at mirror C



Example 2:

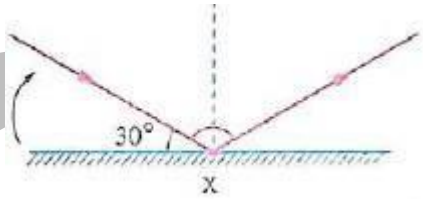
In the opposite figure calculate the angle of reflection.



Solution:

Example 3:

If the mirror gets rotated about point x in the direction shown in the figure by an angle of 10, the angle between the incident ray and the reflected ray becomes……



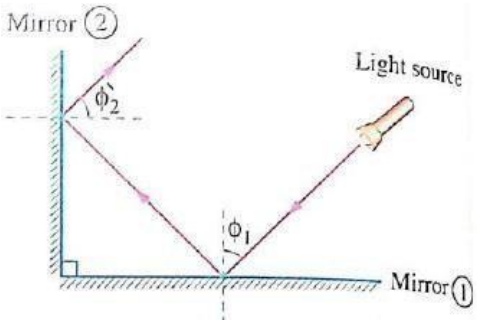
a) 140° b) 135°

c) 125° d) 15°

Solution:

Example 4:

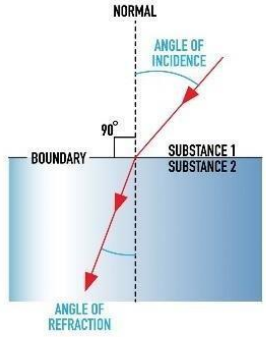
In the opposite figure, if the position of the light source is changed such that the angle of incidence (Ø1) increases by 5°,the angle Ø2` , will …….

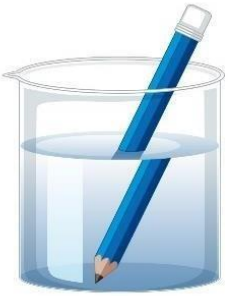


a) increase by 5° b) increase by 10°

c) decrease by 5° d) decrease by 10°

Third: Light refraction:





Occurrence:

When a beam of a parallel light rays falls on the interface (boundary surface) between two transparent media of different optical densities.

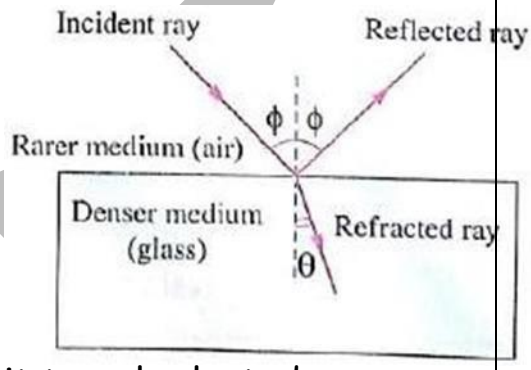
1) Part of the light gets reflected in the first medium.

2)Part of light passes to the second medium deviated from its direction and this phenomenon is known as **light refraction.**

3) Very small part of light gets absorbed in the second medium.

Optical density of a medium:

The ability of the medium to bend light rays when they enter into it.



Light refraction

It is a phenomenon that changes light's direction when it travels slanted through the interface between two transparent media of different optical densities.

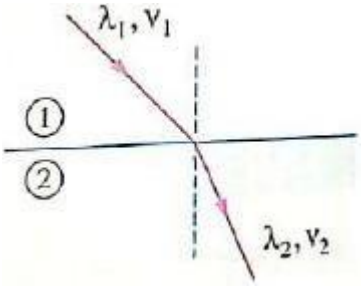
The angle of refraction (θ).

It is the angle between the refracted light ray and the normal line on the interface between the two media at the point of incidence.

The reason why the rays refracted between two mediums:

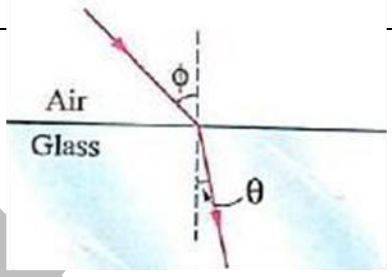
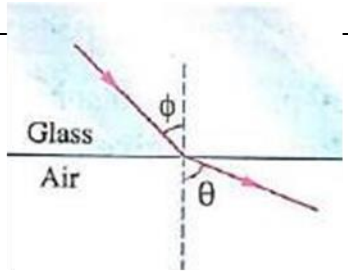
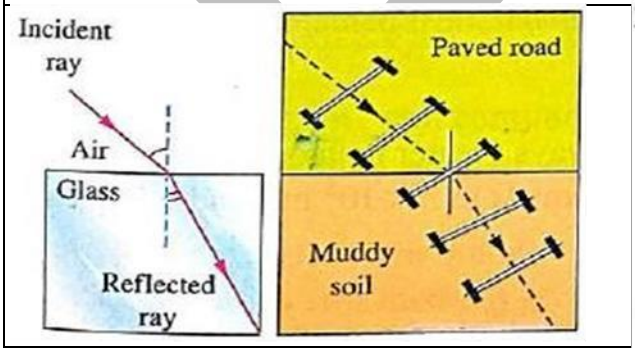
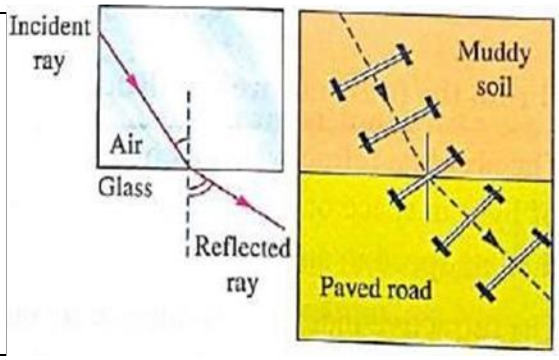
The refraction of light occurs due to the different speeds of light in the two media as a result of the different optical densities of the two media.

Light refraction obeys two laws, which are:



First law of refraction:

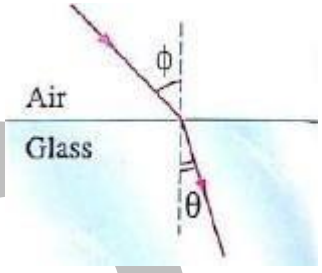
Second law of refraction:

An optically rarer medium To An optically denser medium	An optically denser medium To An optically rarer medium
From air to glass	From glass to air
So light rays are refracted (bent)	
	
This can be resembled by	
	

The factors affecting the relative refractive index between 2 media:

1. The types of the two media (their optical densities).
2. The wavelength of the incident light ray.

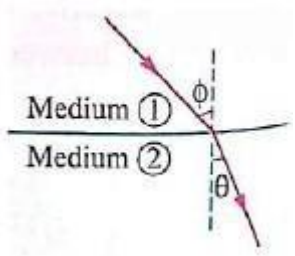
The absolute refractive index of a medium:



Snell's law:

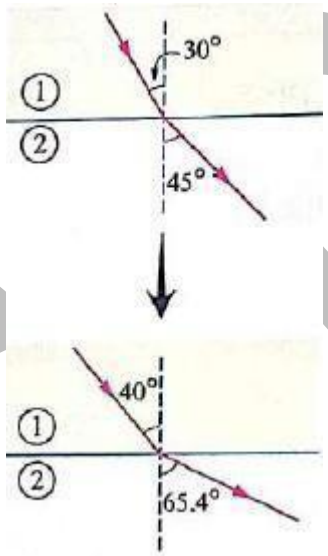
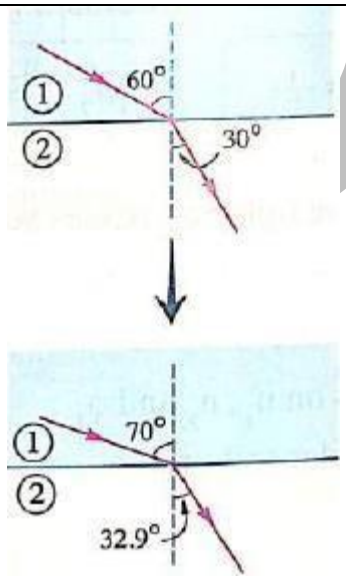
From the first law of refraction:

$$_1n_2 = \frac{Sin\phi}{Sin\theta} \quad , \quad _1n_2 = \frac{n2}{n}$$



$$\therefore \frac{Sin\phi}{Sin\theta} = \frac{n2}{n} \quad \text{so} \quad \boxed{n1 \sin \phi = n2 \sin \theta} \ldots(vip)$$

First medium second medium

If	
$n1 > n2$	$n1 < n2$
Then	
$\emptyset < \theta$	$\emptyset > \theta$
So, when increasing the angles of incidence (Ø) with a given value, the angles of refraction (θ) increase with	
A greater value Where $\frac{n1}{n2} > 1$	A lower value Where $\frac{n1}{n2} < 1$
Examples	
	

Example 1:

If the absolute refractive index of water is $\frac{4}{3}$ and the absolute refractive index of glass is $\frac{3}{2}$,calculate:

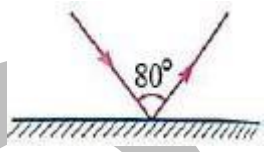
(a) The relative refractive index from water to glass.

(b) The relative refractive index from glass to water

Exercise (3)

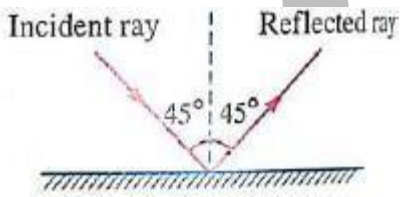
Choose the correct answer:

1) The opposite figure shows a light ray falling on the surface of a plane mirror and bouncing back, hence the angle of reflection of the ray from the surface of the mirror equals



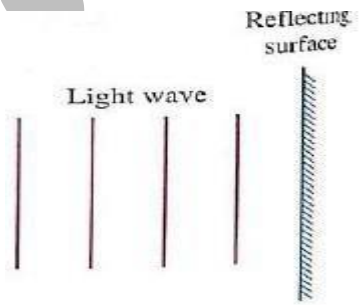
a) 40° b) 50° c) 80° d) 100°

2) In the opposite figure a light ray is incident with a speed (v) on the surface of a mirror and gets reflected from it, so the speed of the ray after its reflection becomes……



a) $\frac{1}{\sqrt{2}}$ v b) v c) $\sqrt{2}$ v d) 2 v

3)The opposite figure shows a light wave being incident on a reflecting surface, what will be the value of the angle of reflection for this wave after striking the reflecting surface?

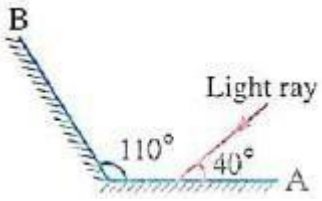


a) 0° b) 45° c) 90° d) 180°

4)If a light ray is incident perpendicular to a plane mirror, the angle of deviation of the ray from its path equals……

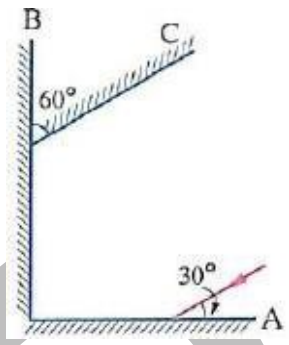
a) 0° b) 90° c) 360° d) 180°

5) In the opposite figure, the angle of reflection of the light ray from mirror B equals .....



a) 20° b) 40° c) 60° d) 70°

6)In the opposite figure, which of the following statements is correct?



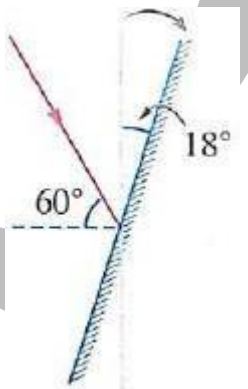
a) The ray is reflected from mirror C at an angle of 30°

b) The ray is reflected from mirror C at an angle of 45°

c) The ray is reflected from mirror C at an angle of 60°

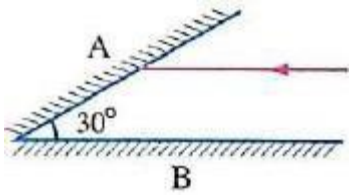
d) The ray is reflected parallel to mirror C.

7) A light ray is incident on a plane mirror with an angle of 60°. If the mirror is rotated by an angle of 18° in the clockwise direction while keeping the incident ray in the same direction as in the figure, then the angle of reflection becomes……



a) 18° b) 48° c) 42° d) 78°

8) If a light ray is incident on mirror A while being parallel to mirror B as shown in the opposite figure:



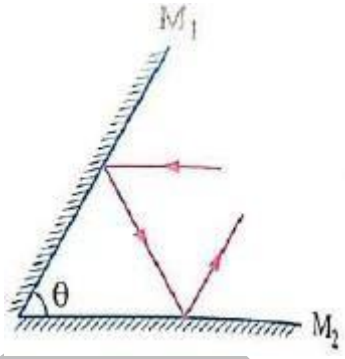
(i) The light ray gets reflected from mirror A and falls on mirror B by an angle of incidence that equals……

a) 90° b) 60° c) 30° d) 0°

(ii) The reflected light ray from mirror B falls again on mirror A with an angle of incidence that equals

a) 90° (b) 45° c) 30° d) 0°

9) The opposite figure, a light ray is incident on mirror M_1 parallel to mirror M_2, hence the ray gets reflected from mirror M_1 to fall on mirror M_2 and get reflected from it parallel to mirror M_1 so angle θ equals.....



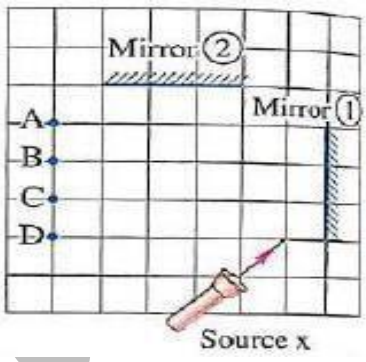
a) 30° b)45°

c) 60° d) 90°

10) The incidence of a laser ray from source x on mirror (1), hence after the ray gets reflected from mirror (2), it passes through point.....

a) A b) B

c) C d) D



11) When a light ray is incident from air with an acute angle on a glass surface, its direction gets change due to the change of..... between the two media.

a) The amplitude of light wave b) The color of light

c) The frequency of light d) The speed of light

12) When a light wave passes from an optically rare medium to another optically denser medium with an angle of incidence = zero, which of the following light properties does not change?

a) The wave speed b) The wave amplitude (intensity)

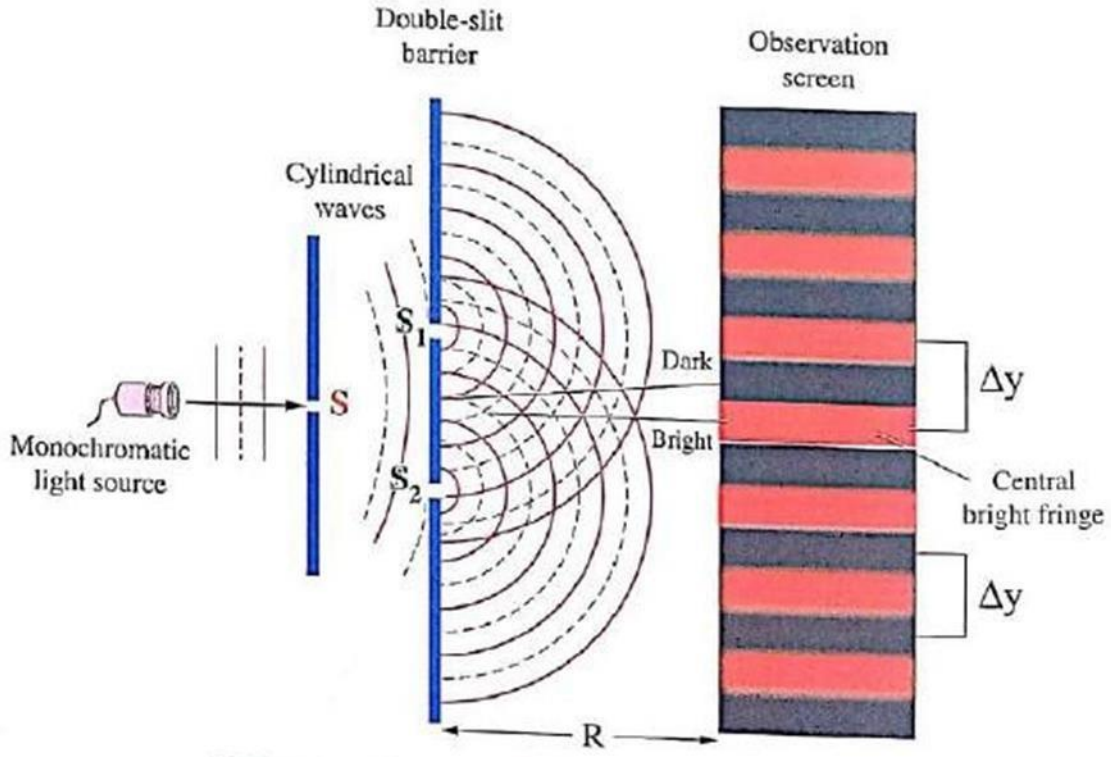
b) The direction of propagation d) The wavelength

Chapter 2: Properties of light

Lesson 2: (Interference and diffraction)

Third Interference of light:

1	2
A reinforcement in the intensity of the two waves at some positions "constructive interference"	A weakness in the intensity of the two waves at some other positions "destructive interference"
As a result of	
The overlap (superposition) of a crest from one wave with a crest from the other wave or a trough from one wave with a trough from the other wave.	The overlap (superposition) of a crest from one wave with a trough from the other wave.



Schematic diagram of Young's double-slit experiment

1- When turning on the light source, the light waves pass from slit S in the form of cylindrical waves, where:

- The continuous curves represent wave crests,

- The dashed curves represent wave troughs.

2The two slits (S,,S,) are adjusted, so when the light waves reach them, they will be at the same cylindrical wavefront, so they act as two coherent sources, i.e. They produce two coherent waves having the same frequency, amplitude and phase.

3The two waves from S_1 and S_2 propagate beyond the double slit barrier and when they reach the last screen, they interfere with each other and give a pattern of interference (as shown in the previous figure) and this phenomenon is known as the interference of light and it can be defined as follows:

Interference of light:

It is the phenomenon of superposition of the light waves that are produced from two coherent sources causing reinforcement in light intensity in some positions (bright fringes) and weakness in light intensity in other positions (dark fringes).

relation. $\Delta y = \frac{\lambda R}{d}$ .....vip

Where: (λ) is the wavelength of the used light, (R) is the distance between the double-slit barrier and the observation screen and (d) is the distance between the two slits.

As studying Young's double-slit experiment, we find that:

(1) Conditions for the occurrence of light interference:

• The used light source must be monochromatic.

•Slit S must be at equal distances from the two slits S_1, S_2 for making the double-slit work as two coherent light sources.

2- The interference of waves is of two types:

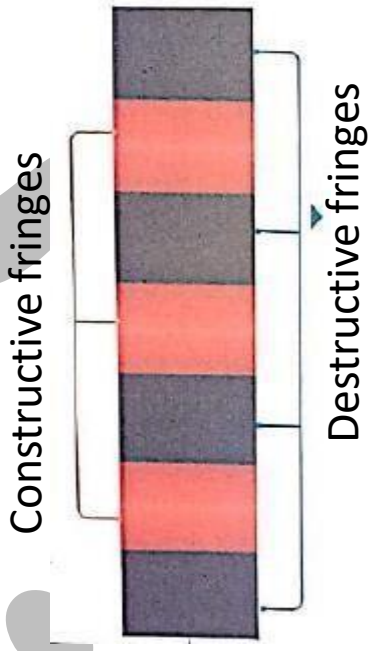
It produces :

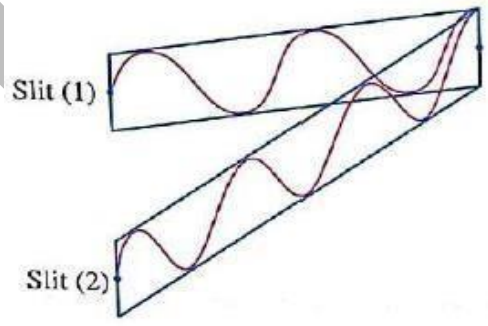
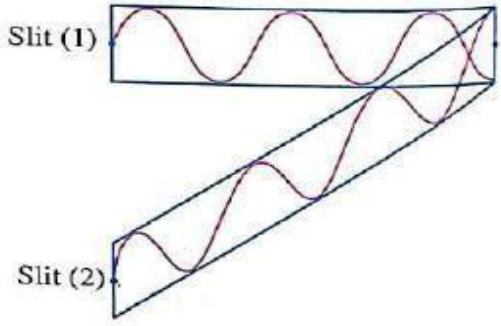
1 Constructive interference:

Reinforcement in the intensity of the light in some regions (bright fringes) as a result of the overlapping of a crest of one wave with a crest of another wave or a trough of one wave with a trough of another wave.

2 Destructive interference:

Weakness in the intensity of the light in some regions (dark fringes) as a result of the overlapping of a crest of one wave with a trough of another wave.

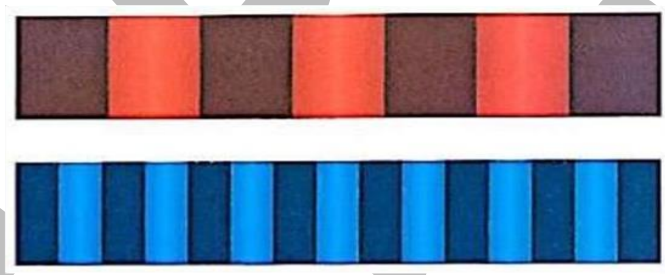


	Constructive fringes	**Destructive fringes**
condition	The path difference of the two interfered waves = $m\lambda$	The path difference of the two interfered waves = $(m+\frac{1}{2})\lambda$
Where: m is the order of the fringe which is an integer number (0,1,2, ...).		
Representatio		

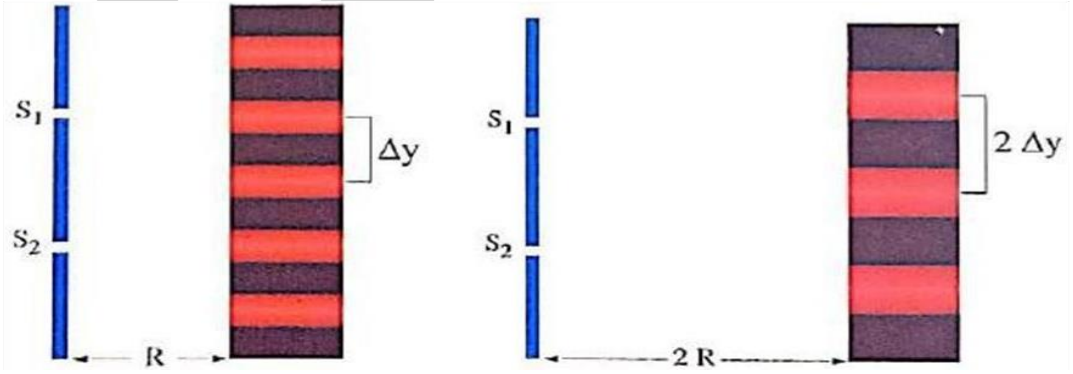
7- The two waves that have equal path lengths give the central fringe which is always a bright fringe because the path difference at this fringe equals zero, so the interference becomes constructive.

<u>The factors affecting the distance between the centers of two successive fringes of the same kind:</u>

2) In Young's double-slit experiment, it is preferable to use a light of relatively long wavelength to make the distance between the binterference fringes relatively large, hence the interference pattern becomes easier to be observed as shown in the following figure where $\lambda_b < \lambda_r$.



When increasing the distance between the double-slit barrier and the observation screen (R), the distance between the interference fringes increases according to the relation ($\Delta y = \frac{\lambda R}{d}$) as represented in the following figure:



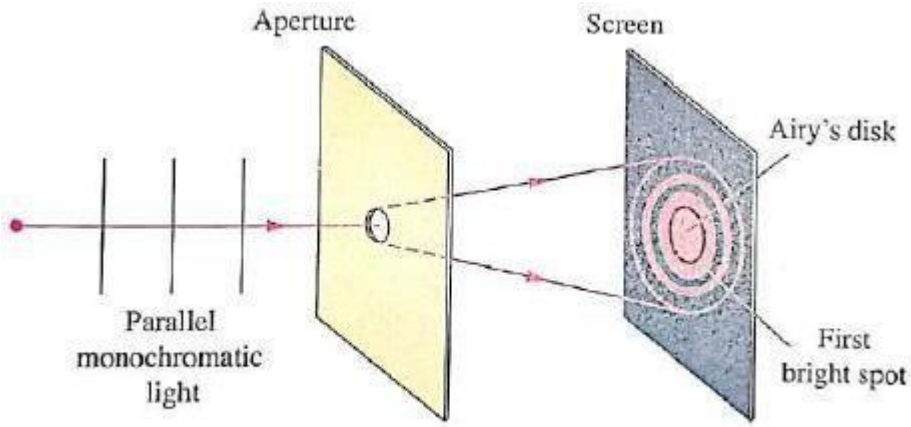
Example 1:

In double slit experiment; if the distance between the two narrow rectangular slits was 0.15 mm, the distance between the double –slit barrier and the observation screen was 75 cm and the distance between the centers of the two successive bright fringes was 0.3 cm, calculate the wavelength of the used monochromatic light source.

Example 2:

The opposite figure represents the interference pattern of Young's experiment which was conducted with a light of wavelength 5000 Å and an observation screen at distance 120 cm from the double-slit. If the distance between the central fringe (0) and the fourth bright fringe (4) was 0.8 cm, calculate the distance between the two slits.

Fifth Light diffraction:



Diffraction on a circular aperture

What happens can be explained as follows:

When monochromatic light waves fall on a sharp edge or on a circular aperture of a barrier whose size is small compared to the wavelength of the incident light:

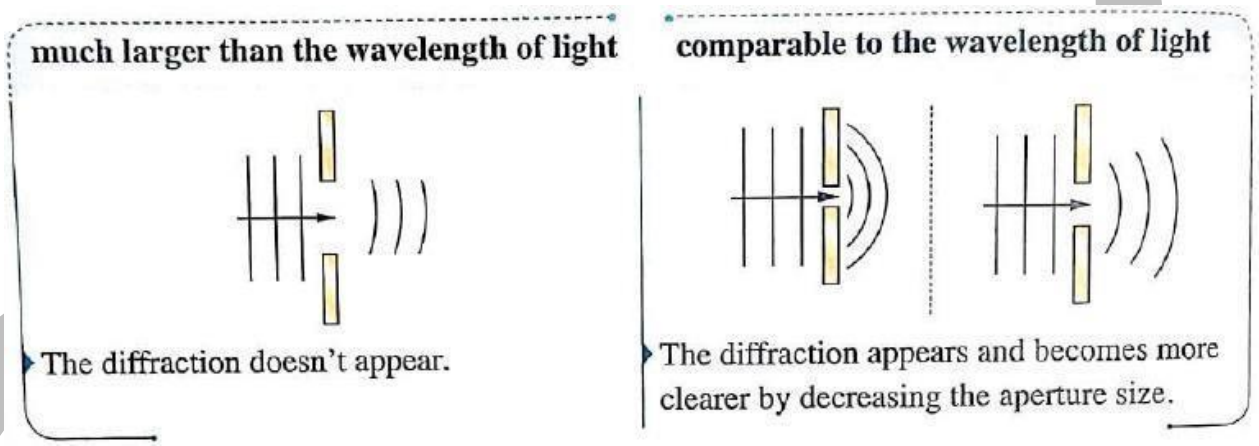
- They change their direction of propagation (diffract).
- Each point on the wavefront of the wave passing through the aperture acts as a secondary light source that forms waves of the same wavelength and phase.
- These waves interfere (superpose with each other behind the aperture giving diffraction fringes.

Diffraction fringes pattern:

It is a pattern of alternate bright and dark regions produced due to the superposition of the diffracted light waves as passing from an aperture of a very small size or falling on a sharp edge.

The condition of a clear appearance of light diffraction:

The wavelength of the light wave has to be close in size to the dimensions of the aperture, so if the aperture size is:



From the previous, light diffraction can be defined as follows:

Diffraction of light:

It is the phenomenon of changing the direction of light waves propagation through the same medium when they pass through a very narrow aperture or fall on a sharp edge in which the superposition of waves leads to the formation of bright and dark fringes.

Interference	Diffraction
1 It appears when using a double-slit. 2Bright and dark fringes that are equally spaced are formed. 3Light intensities at the centers of the bright fringes are equal.	1 It appears when using a single narrow slit. 2Central wider bright fringe surrounded by less wide bright fringes are formed. 3light intensities at the centers of bright fringes get dimmer as we get away at the two sides from the central fringes

From the previous, the wave properties of light can be summarized as the following:

1. Light rays propagate in straight lines in the homogeneous medium.

2.They reflect when they fall on a reflecting surface, according to the laws of reflection.

3.They refract when they travel between two transparent media of different optical densities, according to the laws of refraction.

4.Light waves interfere when they meet other waves that have the same frequency, amplitude and phase producing regions of constructive interference (maxima) and regions of destructive interference (minima).

Exercise (4)

Choose the correct answer:

1) The interference of light, is resulted due to.....

a) the bouncing of waves b) the deviation of waves

c) the superposition of waves d) the change of the speed of light

2) The double-slit in Young's double slit experiment works as two coherent light sources, in which coherence means that the two waves formed from the double-slit have the same..... .

a) phase b) amplitude c) speed d) direction

3)In Young's double-slit experiment, the widths of interference fringes don't depend on.....

a) the distance between the two coherent sources

b)the distance between the double-slit barrier and the observation screen

c) the wavelength of the light emitted from the source

d) the distance between the double-slit barrier and the light source

4)In Young's double-slit experiment, the interference fringes widths increase when .....

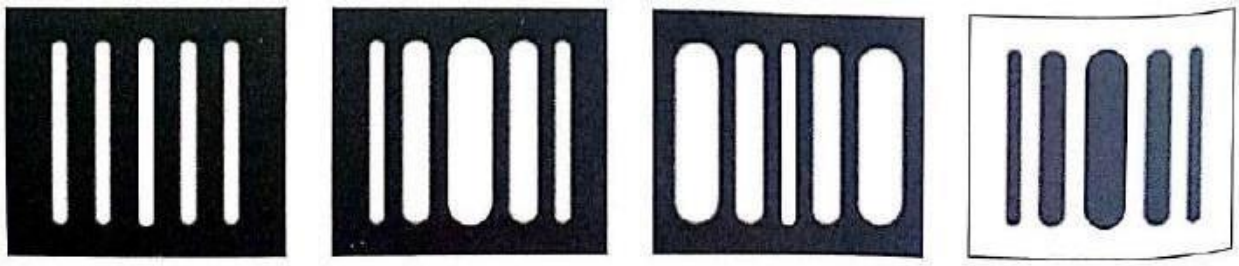
a)the distance between the double-slit and the observation screen decreases

b)the distance between the double-slit and the observation screen increases

c) the distance between the two slits increases

d) the wavelength of the used monochromatic light decreases

5) Which of the following figures represents the interference pattern formed in a Young's double slit experiment?

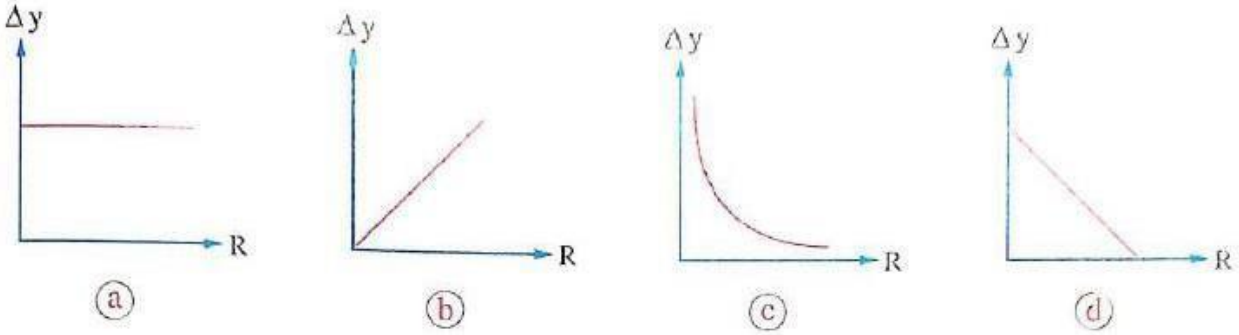


ⓐ ⓑ ⓒ ⓓ

6)In a Young's double-slit experiment, when increasing the intensity of the used light, the distance between the center of the central fringe and that of the first dark fringe…….

a) increases b) decreases c) vanishes d) doesn't change

7) In Young 's double-slit experiment, which of the following figures, represents the graph of the distance between the center of the central fringe and the center of its following bright fringe (Δy) versus the distance between the double-slit barrier and the screen (R)?



ⓐ ⓑ ⓒ ⓓ

8)A Young's double-slit experiment, the separation distance between the two slits was 10^{-4} m and the distance between two consecutive fringes of the same type was found to be 3.75 mm when they appeared on an observation screen at a distance 0.75 m from the two slits, so the wavelength of the used light equals……

a) 5000 Å b) 5400 Å c) 6000 Å d) 6400 Å

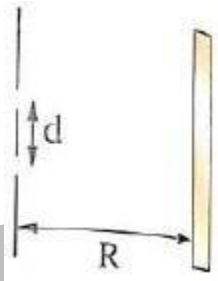
9)In a Young's double-slit experiment, if the distance between the two coherent sour was 1.6 mm where the interference fringes were formed on a screen at a distance of 60 cm from them such that the center of the third bright fringe was at 0.6 mm from the center ø the central fringe, then the frequency of the used light equals.....

(Given that: the speed of light in air = (3×10^8 m/s)

a) 4.08×10^{16} Hz b) 5.63×10^{14} Hz

c) 4.74×10^{12} Hz d) 7.08×10^{11} Hz

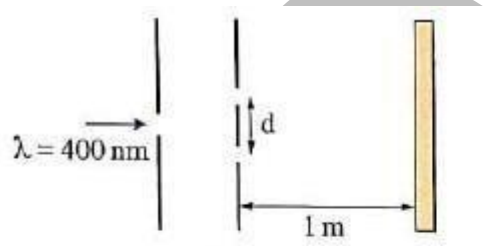
10) In Young's double-slit experiment represented in the opposite figure, if R = 10^4 d, then.....



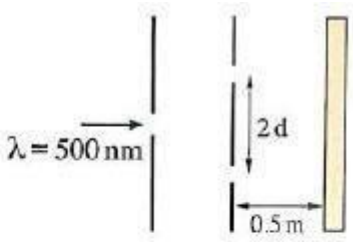
a) $\Delta y = \lambda$ b) $\Delta y = 10^4 \lambda$

c) $\Delta y = 10^{-4} \lambda$ d) $\Delta y = \frac{\lambda}{10}$

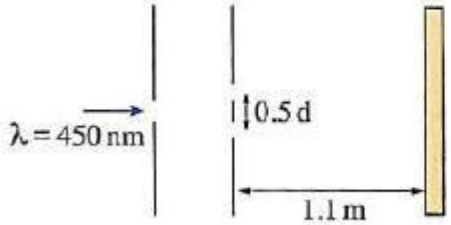
11) Which of the following diagrams of Young's double-slit apparatus will yield the best noticeable interference fringes?



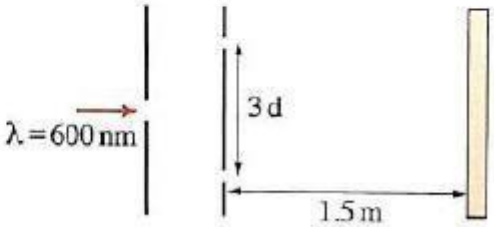
(a)



(b)



(c)



(d)